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ENGINEERING NEWS.

A COMPOUND LOCOMOTIVE for the Old Colony R. R. has been designed by MR. F. W. DEAN, of Boston. The cylinders will be 20 × 24 ins., and 28 × 24 ins. Driving wheels, 69 ins. diam.; truck wheels 36 ins. diam. Boiler pressure, 200 lbs. The boiler is 56 ins. diam., and is being built at the South Boston shops of the railway company, under the supervision of Mr. LAUDER, Superintendent of Motive Power. The engine will be used for express service between Boston and Providence. The design includes several details which have been patented by MR. DEAN.

SOME MORE FAIRLIE LOCOMOTIVES for the Mexican Ry. have recently been built by Neilson & Co., of Glasgow, Scotland. These engines are carried on six pair of drivers, three pair in each "bogie," or steam truck. The driving wheels are 3 ft. 6 ins. diameter, and the trucks have each a wheel base of 8 ft. 3 ins. The total wheel base is 32 ft. 5 ins., and the engine can pass a curve of 330 ft. radius. There are two cylinders on each truck, 16×22 ins. The boiler pressure is 165 lbs. In working order the engine weighs 92 tons, and all this weight is available for adhesion. The tank capacity is 2,850 galls., and the coal space is 300 cu. ft. These engines are run on a section of track about 14 miles in length, on which the grades are nearly 4 per cent., with no compensation for curves. These engines are said to have more weight available for adhesion than any other locomotive in existence. Engines of this type have been in use on the Mexican Railway for some years, and have given satisfactory performance.

THE STRONG LOCOMOTIVE CO. has purchased 1,350 acres of land in the outskirts of Cincinnati, at an average cost of $275 per acre, and will at once erect a very complete works, 700 × 500 ft., covering nine acres, with a capacity of one locomotive per day. All other kinds of locomotives, as well as the Strong, will be built. The construction of the works is expected to take nearly a year.

EXTENSION SMOKE-BOXES or some spark arresting devices would seem to be a desirable equipment for locomotives in India. *Indian Engineering*, of Calcutta, stated recently that fires on passenger trains are now so frequently dangerous to the public safety that the early adoption of some precautionary measures to lessen the present risk are evidently desirable. The personal baggage of passengers is constantly taking fire from the sparks thrown out in vivid streams of flame from the engine chimneys; and in this respect the native passengers suffer most severely, owing to their habitual use of inflammable cotton clothing, wraps and quilts. In one case the brake van of a passenger train on the Northwestern Ry. was burnt, two dogs perished in the flames, and the passengers' baggage was destroyed.

HEAVY LOCOMOTIVES seem likely to be a feature of railway equipment. Consolidation engines having a weight of 40,000 lbs. on each of four axles are reported to be proposed by several roads. The New York, Lake Erie & Western R. R. has a passenger engine with 78,000 lbs. on two axles, or 19,500 lbs. per wheel. The New York Central & Hudson River R. R. is having passenger engines built which will have a weight of 10 tons on each of the four driving wheels.

STEAM HEATING OF CARS IN GERMANY, according to *Kuhlow's German Trade Review*, is progressing rapidly. On almost all the main lines of the Prussian State railways steam heating has been introduced, and it is intended in time to use it on the entire system. The steam is supplied from the locomotive and passes through the pipes running underneath the carriages at a pressure up to 30 lbs. per sq. in. In the first and second class cars the temperature can be regulated by the passengers, while in the third class it is necessary to call the guard or other official when it is desired to alter the temperature.

STEEL TIES are to be tried on the Delaware & Hudson road. An order for 1,500 "Standard" ties has been given to the Standard Metal Tie & Construction Co., of 15 Cortlandt St., New York, and they will be laid north of Ballston on what was originally a part of the old Saratoga & Schenectady R. R. The ties are to be 7 ft. long and 7 ins. wide; they will be in gravel ballast and will be spaced 2 ft., 2ft. 6 ins., and perhaps 3 ft. apart for experimental purposes. The rails weigh 67 lbs. per yd., and rest on blocks of compressed wood. The joint is of a new type: a channel bar 4 ins. deep is placed under the rail ends, and a clamp on each side takes hold of the rail flange and the bottom of the flange of the channel. Four bolts, with the Harvey grip thread, pass through the clamps and channel bar. No ordinary splice bars are used, the rails being held by the flanges only. The joint ties are spaced 2 ft. apart, and the channel bar and clamps are as long as the distance between these ties. The order for the ties was given through Mr. H. G. YOUNG, second Vice-President of the road, and Mr. A. J. SWIFT, Chief Engineer. The Standard ties have been described in ENGINEERING NEWS, June 29, 1889, and Feb. 8, 1890. They are in use on the Chicago & Western Indiana R. R.

THE AMERICAN STEEL BARGE CO., which has lately removed its yard from Duluth to West Superior, Wis., will have four boats on the stocks and well under way by July 1; and the plant, which has a capacity for building eight boats at a time, will be running at its full capacity within eight months. The first two boats built will have a carrying capacity of 2,500 tons, and the two consorts will be 3,000 tons. Each steam barge is to be able to tow two or three consorts at a fair rate of speed. The cost of the present plant will be $550,000, and it is expected to turn out twenty of these barges yearly at an annual expenditure of about $2,000,000.

A NAVAL APPROPRIATION BILL of $22,151,253 has been handed in by the House Committee on naval affairs. This bill provides for the contruction of three sea-going, coast line-of-battle ships of 8,500 tons each, with heavy armor and guns. Though not specified, 17-in. armor is intended, with guns to correspond. They are to have a coal capacity of 5,000 miles, and are to cost not exceeding $4,000,000 each. The committee also provides for a cruiser of 7,300 tons, to cost $2,750,000, and have a minimum speed of 20 knots. Items for navy yards, new guns ($2,500,000), continuing work on vessels now under contract, etc., swell the amount to sums first named.

THE SPEED TRIAL OF THE CUSHING TORPEDO BOAT, before referred to, was as follows: The time required to make the mile—which was a sea mile—or knot, was: First time, 2 min. 49.4 sec.; second time, 2 min. 35.4 sec.; third time, 2 min. 45.2 sec.; fourth time, 2 min, 36.8 sec.; fifth time, 2 min. 41.9 sec.; sixth time, 2 min. 38.2 sec.; seventh time, 2 min 37.2 sec. The average of these times is 2 min. 40.6 which corresponds to a speed of 22 knots an hour. As, however, the torpedo boat had to turn eight times during the three hours, involving a slight decrease of speed, the average speed for the whole three hours will be somewhere near 22.5 knots, probably not more than one-tenth of a knot less. The builders are not entitled to any bounty for this excess, as the contract stipulated that no bounty is to be paid unless the speed exceeds 23 knots.

THE LARGEST KRUPP GUN MADE AT ESSEN, says the American consul at Dusseldorf, is made of the finest quality of cast steel, and weighs 270,000 lbs. (about 135 tons); the calibre is 16¼ ins., and the barrel 44 ft. long, the core having been removed in one piece. The greatest diameter is 6½ ft., and the range about 12 miles. It will fire "two shots per minute," each estimated to cost $1,500. At the trial the projectile, 4 ft. long and weighing 2,000 lbs., was propelled by a charge of 700 lbs. of powder, and penetrated 19 ins. of armor. It was carried from Essen to Hamburg on a car specially constructed for the purpose. Work is now being pushed forward on several guns of this class, and a number of smaller ones have recently been ordered. This large gun is intended for the fortifications at Cronstadt.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was the wreck of a passenger train on March 25, on the Northern Pacific R. R., near Heron, Mont., 6 miles from the Idaho line. The accident was caused by the giving way of a culvert over which another train had just passed. The engine and tender, mail, baggage, express and passenger cars were ditched; the dining car and two sleeping cars remained on the track. Three persons were killed and 6 or 7 injured. The wreck caught fire, and the express messenger, who was caught in it, was burned to death.——A rear collision of freight trains occurred on the Pennsylvania R. R., at Lilly's Station, Pa., March 26. The wreck caught fire, and some buildings were also burned.——The blind tires of a freight engine on the Cairo Short Line left the rails while the engine was hauling a coal train near Centreville Station, Ill. The engine and 11 cars were wrecked.

BRIDGE AND TRESTLE ACCIDENTS are reported as follows: The covered wooden bridge of the Spartanburg & Union R. R., over the Broad River, near Shelton, S. C., was blown down recently. All of the seven spans of 25 ft. each were destroyed. An iron bridge will probably be built.——A small trestle on the Chicago, St. Paul, Minneapolis & Omaha R. R., near Dakota City, Neb., was destroyed by fire March 26.

PART OF THE DAM on the Little Kanawha River, at Palestine, W. Va., gave way March 31. The break was nearly 100 ft. wide, and the damage is estimated at $20,000.

THE NORTH RIVER BRIDGE BILL passed the House of Representatives at Washington on April 2. It gives authorization to JORDAN L. MOTT, JNO. KING MCLANAHAN, JAS. ANDREWS, THOMAS F. RYAN, GARRETT A. HOBART, F. W. ROEBLING, CHAS. J. CANDA, EDW. F. C. YOUNG, HENRY FLAD, GUSTAV LINDENTHAL, A. G. DICKINSON, JOHN H. MILLER, WM. BROOKFILD, SAML. REA, WM. F. SHUNK, PHILIP E. CHAPIN, and their associates, as a corporation, to locate, build, maintain, equip and operate a bridge, proper approaches thereto, and terminals, appurtenances and works connected therewith, across the Hudson River between the City of New York, in the State of New York, and the State of New Jersey, and to lay tracks thereon for the connection of the railroads on either side of said river, in order to facilitate inter-State commerce in the transportation of persons and property. Provided, that the bridge shall have not less than six railroad tracks, with a capacity for four additional tracks for future enlargement, and shall be constructed with a single span over the entire river between the towers located between the shore and the established pierhead lines in either State, and at an elevation above the river not less than that of the existing Brooklyn suspension bridge over the East River, and that no pier or other obstruction to navigation, either of a temporary or permanent

character, shall be constructed in the river between the towers.

The construction of the bridge shall be begun within 3 years and completed within 10 years after the beginning. The plans of the bridge are to be approved by the Secretary of War. The persons named and their associates are constituted and created a body corporate in law, to be known as the North River Bridge Co. All persons, railroad and telegraph companies desiring to use the bridge shall be entitled to equal rights and privileges in the passage over and the use of the same and the approaches thereto, for a reasonable compensation, to be approved by the Interstate Commerce Commission.

THE EAST RIVER BRIDGE BILL, now before the Albany Legislature, has been pushed to a third reading. The exact locality of this bridge is not defined, and it is strongly intimated in the press reports that its promoters seek its passage for speculative purposes.

THE QUEBEC RAILWAY CO. has made application to the Privy Council at Ottawa for permission to bridge the St. Lawrence near Quebec. The site selected is opposite the mouth of the Chaudiere, where the river is 3,000 ft. wide. The design calls for cantilevers on the plan of the Forth Bridge, but with one 1,400 ft. opening and two of 700 ft. The plans were prepared by Sir JAMES BRUNLEES, of London, and Mr. A. L. LIGHT, M. Inst. C. E., Government Engineer, of Quebec.

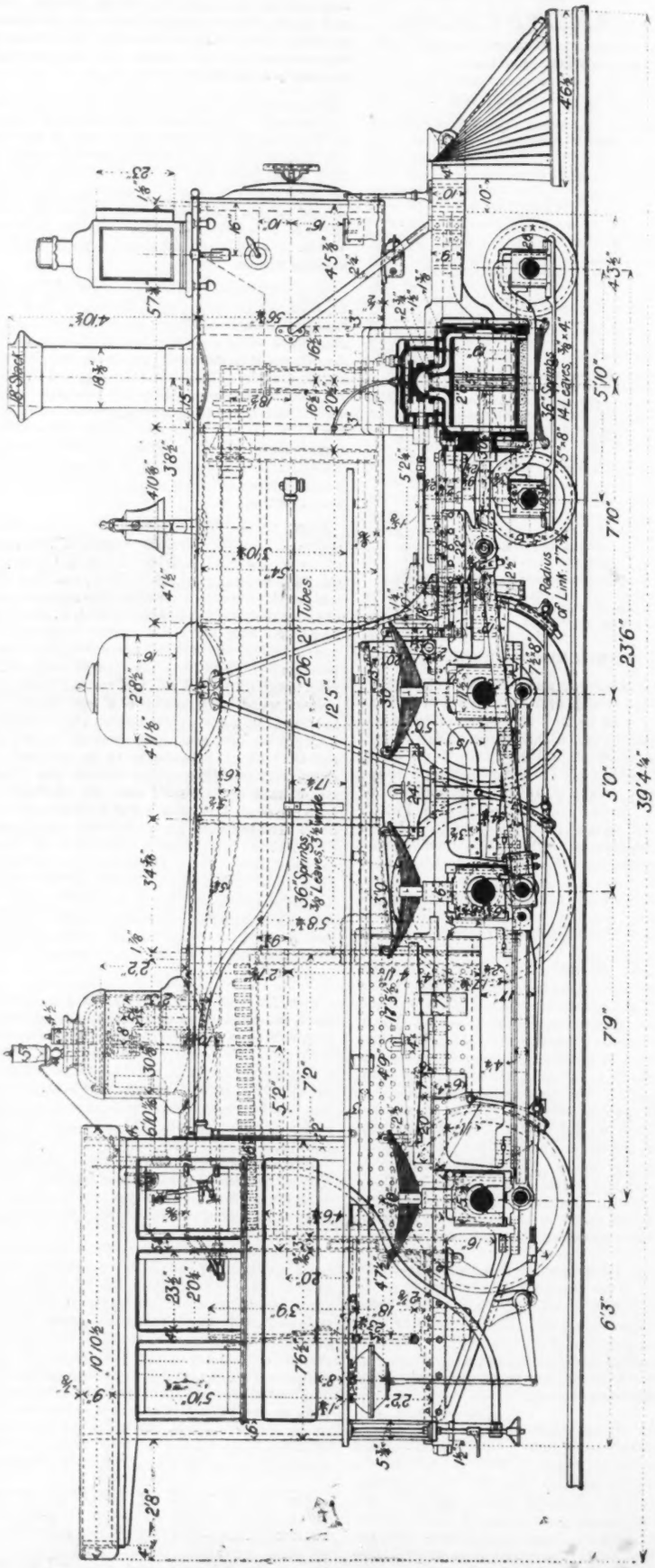
A STREET PAVING EXHIBITION, soon to be held in Indianapolis, promises unusual interest if the programme is carried out as issued. It is announced that over 400 cities have been invited to send representatives, and all the leading paving companies will have exhibits. Papers are to be read on the subject by experts, and the merits of various types of practice discussed.

THE EXPENSE OF CLEANING THE STREETS OF FRANKFURT-ON-MAIN, which includes the removal of snow, ice and refuse, was $38,980 in 1887-88, and $40,480 in 1888-89. The area cleaned during the first named year was 639,830 sq. yds., during the second 687,000. The average cost, therefore, per sq. yd. was about 6 cents.

THE CLEANING of New York's streets is still a vexed question. Mr. HORACE LOOMIS, who was recently appointed Commissioner of Street Cleaning, has resigned on account of the worry and annoyance attendant upon the position. Mr. H. S. BEATTIE, ex-Surveyor of the Port, has been appointed to succeed him.

THE ROADS OF MERION TOWNSHIP, near Philadelphia, are the best in the State of Pennsylvania. The credit for the present condition of affairs is due to Mr. A. J. CASSATT, one time Vice-President of the Pennsylvania R.R. Co. He lived in that township, and being disgusted with the bad condition of the country roads, he had himself elected a township supervisor. He horrified the farmers at first by spending the whole road tax for one year in macadamizing one short piece of road, instead of scattering it in vain work over many miles. But he continued his method from year to year until now every road in the township is macadamized and the annual tax for maintenance is very small. A little of the same medicine would work like success in many other sections than Merion. It is not the amount of money expended, but the manner in which it is expended that makes the difference between wasteful failure and gratifying success.

AT THE HUDSON RIVER TUNNEL an accident occurred this week which may greatly delay the completion of the enterprise. On March 30 smoke was noticed issuing from the roof of the caisson on the New York side, and to extinguish the fire the caisson was flooded. When it was attempted to pump out the water again, it was found that a hole had been burned through the roof of the caisson, making it impossible to force the water out. Divers are now at work trying to locate the leak and stop it, and, of course, work is at a standstill until the caisson is made tight, so that the water can be forced out.



Ten-Wheel Locomotive: Georgia Pacific R. R.
Longitudinal Sectional Elevation.

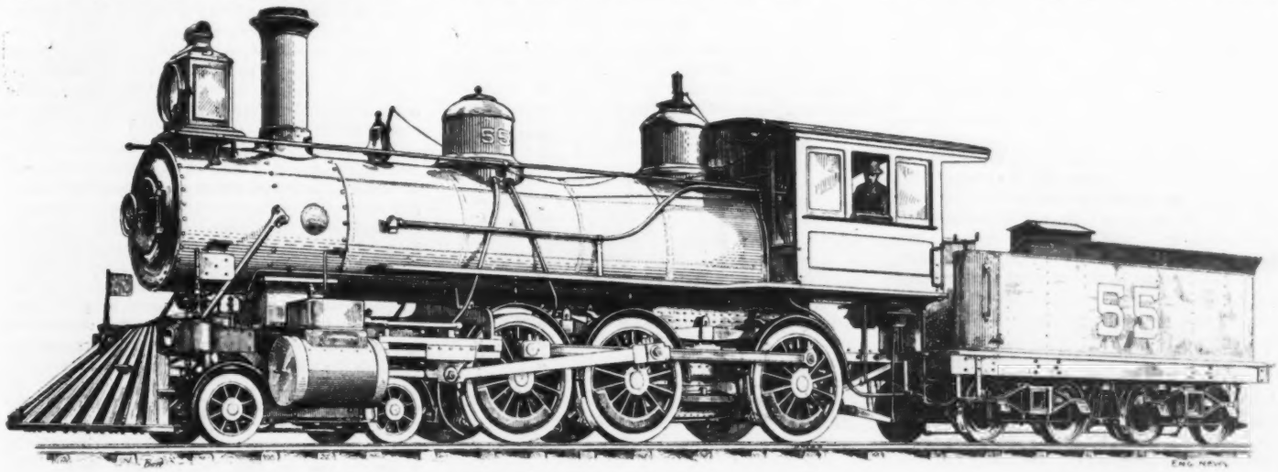
Ten-Wheel Locomotive—Georgia Pacific Railroad.

The ten-wheel type of locomotive, having six coupled driving wheels and a four-wheel leading truck, is coming into more general use, both for passenger and freight service. One reason for this is the increasing weight of fast trains. Where the American or eight-wheel type, having four coupled driving wheels and a four-wheel leading truck, has not sufficient capacity for the traffic, the mogul type, having six coupled wheels and a two-wheel pony truck, has been employed, and with advantage, in cases where high speed cannot be maintained on account of the grades. Mogul engines have also been used for fast passenger traffic, as on the Lake Shore & Michigan Southern Ry., and the New York & New England R. R. For this class of traffic, however, the ten-wheel engine presents some advantages over the mogul engine; it may have a longer boiler and greater steaming capacity, which fit it for fast running, and the four-wheel truck is generally considered to make a steadier running engine and to be less destructive to the track than a pony truck. Both of these advantages adapt this type of engine especially for fast running, and outweigh the disadvantage of increased weight due to the large boiler. For slower speeds the mogul type has the advantages of equal tractive power and a less weight of engine to be hauled. The Michigan Central R. R. has used ten-wheel engines during the last few years for hauling its fast heavy passenger trains (as noted in ENGINEERING NEWS, March 8, 1890, in which number the compound ten-wheel engine was described), and their satisfactory performance in this service has led to the purchase of a number of engines of the same type by that road. The Canadian Pacific Ry. has some fine engines of this type for heavy passenger service on the division between Montreal and Toronto. The following tables give the leading particulars of three ten-wheel engines and three mogul engines. (A, Canadian Pacific Ry.; B, Michigan Central R. R.; C, Newport News & Mississippi Valley Ry.; D, New York, Lake Erie & Western R. R.; E, Michigan Central R. R.; F, Chicago, Burlington & Quincy R. R.)

We illustrate this week a ten-wheel engine built in 1888 at the Richmond Locomotive & Machine Works, Richmond, Va., for the Georgia Pacific R. R., which is now the Georgia Pacific Division of the Richmond & Danville system. Mr. R. D. WADE, Superintendent of Motive Power, writes as follows: "We have made no special tests of these engines. Their performance, however, compares favorably with engines of other build of the same dimensions. They are remarkably free steamers, are well-designed, and well-built engines."

The following are the leading dimensions and particulars of these engines:

Cylinders	19 × 24 ins.
Slide valves (balanced); travel	5¼ ins.
Outside lap	¾ in.
Inside lap	1-16th in.
Lead	1-16th in.
Radius of link	7 ft. 7¾ ins.
Driving wheels; number, 6; diameter	54 ins.
Forward drivers have blind tires.	
Truck wheels; number, 4; diameter	36 ins.
Journals of driving wheels	7½ × 8 ins.
" of truck wheels	5 × 8 ins.
Boiler, wagon top; extension smoke-box.	
" diameter at the waist	54 and 55⅛ ins.
" thickness of plates	9-16-in.
Fire-box, length	7 ft. 2 ins.
Tubes; number, 266; 2 ins. diam.; length	12 ft. 5 ins.



Ten-Wheel Locomotive: Georgia Pacific R. R.

Heating surface, tubes	1,328 sq. ft.
" " firebox	126 sq. ft.
Total heating surface	1,454 sq. ft.
Grate area	20.6 sq. ft.
Wheel-base, driving	12 ft. 9 ins.
" rigid	7 ft. 9 ins.
" truck	5 ft. 10 ins.
" total	23 ft. 6 ins.
Weight, in working order, on driving-wheels	82,000 lbs.
Weight, in working order, total of engine	105,000 lbs.
" " " engine and tender	169,009 lbs.

The engine is fitted with the Eames driver brake.

Ten-Wheel Engines.

	A.	B.	C.
Class of service	Passenger.	Pass. and Freight.	Freight.
Cylinders	20 × 22 ins.	19 × 24 ins.	19 × 24 ins.
Diam. of driving wheels	75 ins.	68 ins.	57 ins.
Heating surface	1,491 sq. ft.	1,733.8 sq. ft.	1,511.76 sq. ft
Grate area	25.3 "	28.5 "	.....
Weight, total	107,000 lbs.	118,000 lbs	115,000 lbs.
" on driving wheels	84,000 "	94,000 "	95,000 "

Mogul Locomotives.

	D.	E.	F.
Class of service	Passenger.	Freight.	.....
Cylinders	20 × 24 ins.	19 × 24 ins.	19 × 24 ins.
Diam. of driving wheels	68 ins.	58 ins.	68 ins.
Heating surface	1,458.5 sq. ft.	1,417.2 sq. ft.	1,506 sq. ft.
Grate area	(Wootten fire-box)	32.3 "	27.1 "
Weight, total	114,000 lbs.	103,000 lbs.	116,000 lbs.
" on driving wheels	95,500 "	89,500 "	91,500 "

The Mississippi Flood of 1890.

MR. B. M. HARROD, one of the Mississippi River Commission, publishes in the New Orleans *Times-Democrat* a long communication, under the above title, in defence of the general levee building policy of the Commissioners.

To better understand the phenomena to be dealt with, Mr. HARROD divides his subject at the Red River, where the oscillations between high and low water are 50 feet, about the same as at Cairo. Below Red River, this oscillation steadily lowers until it is about zero at the mouth of the Mississippi. In the lowest stages of the river the water, even up to Red River, falls to within 3 or 4 ft. of the Gulf level, and is practically without slope. Above Red River the Mississippi is wider, shallower, changes more from caving and bar-building, and has about the same aggregate fall, but with a different distribution from Cairo down, at all stages.

The present unprecedented high water at New Orleans is not due to the fact that the flood is greater than preceeding ones; but because within the last six years the levees below Red River have been so enlarged that they carry more water past the city than ever before. Thus, in 1882, 1,505,000 cu. ft. of water per second passed Red River Landing, and only 921,000 cu. ft. reached Carrollton, above New Orleans, on the same flood; the difference was lost on the way at Morganza, Bonnet Carre, and through a host of minor crevasses. But this year, on March 14, 1,313,000 cu. ft. per second passed Carrollton; which, with the addition of the 10,000 or 12,000 cu. ft. per second passing out at Lafourche and Nita, may be safely assumed as the flow at Red River Landing. Mr. HARROD gives the maximum discharges and the accompanying gauge reading during the years in which discharge observations have been carried on:

Year.	Discharge Cubic feet per second.	Gauge.	Date.
1851	1,152,000	14.80	March 17.
1858	1,188,000	.....	.....
1880	987,000	13.65	April 1.
1881	792,000	12.55	April 12.
1882	921,000	14.95	March 27.
1883	1,079,000	15.40	April 7.
1885	1,047,000	13.46	Feb. 3.
1890	1,313,000	15.90	March 14.

It will be observed that while, in 1882, less than 1,000,000 flowed by Carrollton with a gauge reading of 14.95, in 1890, with a gauge reading of 15.90, or less than one foot more, the discharge was 1,313,000, or an excess of 392,000 cu. ft. per second. The discharge has increased 43 per cent., while the gauge has risen 7 per cent. Mr. HARROD can imagine no fact more corroborative of the value and feasibility of a levee system, or of the excellent administration of the levees of this State, than this enormous increase of discharge capacity with the slight increase of height and of velocity resulting therefrom. It proves that, with an increase of grade to the levees which is easily within the limit of means, any possible volume of discharge can be certainly controlled.

In treating of the Mississippi between Red River and Cairo, Mr. HARROD first notes that the annual rise and fall varies at different places from 35 ft. to 50 ft., and he tabulates a few of the more characteristic of these points for the high and low water of 1882 and 1886 as follows:

	H. W. 1882.	L. W. 1886.	Annual oscillation.
Cairo	51.87	3.80	48.07
Fulton	36.69	3.86	32.83
Malone	32.62	...	32.62
Helena	47.20	3.00	44.20
White River	48.40	5.90	42.50
Lake Providence	36.47	2.55	33.92
Vicksburg	48.75	...	48.75
St. Joseph	44.80	2.25	42.55
Mouth Red River	48.50	2.75	45.75

On an examination of these tables it will at once be observed that those points where the greatest rise and fall occurs are located at the mouths of the tributaries, while those having lesser oscillations are situated somewhere midway along the fronts of the great basins, between the greater tributaries to the parent stream. Were all the gauge stations included in this tabulation they would be found to corroborate this abstract. But those cited show the general characteristic sufficiently well. These facts have long been known to those who have had occasion and opportunity to observe the river, but an explanation was inaccessible until the Mississippi River Commission had made their surveys, including a line of exact levels from the Gulf up to and above Cairo. Before this was done it had been generally supposed that the contributions of the tributaries raised the height of the flood at their mouths above its general level at intermediate points to the extent given in the foregoing table of gauge readings. When, however, the levels of the low and high water marks recorded on the gauges throughout the river were plotted and referred to a datum, it became apparent that the greater differences between high and low stages at the mouths of the tributaries than at intermediate points were not because the high water was higher at the mouths than elsewhere, but because the low water was lower. In other words, the high water slope presented a tolerably uniform curve, while the low water slope was pretty well broken up by a series of humps or elevations along the fronts of the basins, between the deeper parts found at and about the mouths of the tributaries.

Leaving the official records of the Commission, Mr. HARROD suggests an explanation for the present conduct of the river; in which position he claims the support of past experience and the professional views of the majority of the Commission.

He says that it must be remembered that when a flood of 1,500,000 cu. ft. per second passes Cairo, it may in passing the unleveed front of St. Francis Basin lose a third of this volume by overflow into this basin, and pass Memphis with a volume of about 1,000,000 cu. ft. per second. But the volume lost is again returned to the main river at the foot of the basin, and the normal volume is thus restored. A process similar to this is repeated at various points, to a greater or less extent as the condition of the levees might control.

In addition to this it must be remembered that the Mississippi river is, typically, an alluvial and sedimentary stream, quickly and surely adjusting its bed to its volume. When the foregoing conditions are thoroughly understood and given the weight to which they are entitled, Mr. HARROD believes it will seem a fair conclusion that the abnormal elevations or humps along the fronts of the basins, and the loss of discharge capacity within the natural banks which they cause are the result of the repeated loss of flood volume by overflow between the tributaries, and that the depressions of bed found at or about the mouths of the tributaries are the result of the duty of a larger discharge imposed on the river at these points. If this is true we may expect that the continuous and persistent leveeing of the alluvial river would at first reduce flood heights at the mouths of the tributaries, increase them at intermediate points and, generally, make the high water slope more parallel than it now is to the low water. Observations on the floods since 1882 afford evidence to support these views. The secure leveeing of the Yazoo basin soon after that year has materially lowered the flood height at Vicksburg by cutting off overflow water which would be returned at this point, while this and the more recent leveeing in the Tensas basin have materially raised the flood heights at points above Vicksburg and along the floods of these basins.

It therefore appears that a period of levee building necessarily will be one of transition, in which a redistribution of flood heights and slopes will occur. In some places levees with grades adjusted to previous high waters will become unnecessarily high, if such a thing is possible, while, in other localities, levees which have heretofore proved sufficient will be overtopped under new and changing flood conditions.

Mr. HARROD shows by three profiles of the river, from Cairo to Red River, the relations of the river-bed and the low and high-water marks. The first diagram is a plotting of the heights given in the table above for the high and low water stages, and shows a pretty even slope for the high-water line, but a parallel series of bumps in the low-water line and the river-bed. The second diagram shows what Mr. HARROD calls the transition stage; in which the high-water line is supposed to be disturbed by the construction of levees and made to conform with the bumps in the low-water and river-bed lines; a state of things actually in operation in parts of the river newly leveed. Mr. HARROD believes the irregular slope in the river bed and low-water lines are abnormal; and as being the result of special causes, they will disappear as these causes are removed, and that in time the river-bed, low-water and high-water lines will be practically parallel and on a regular slope from Cairo to Red River, as he shows in a third diagram.

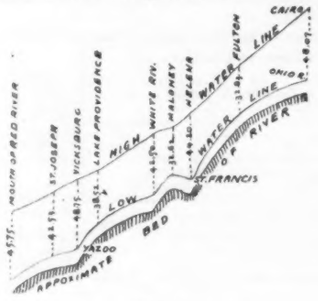


Fig. 1.

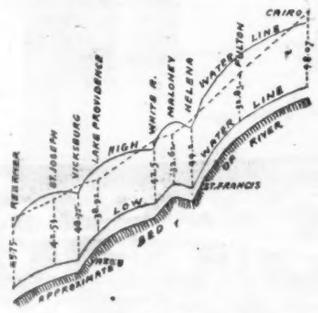


Fig. 2.

In conclusion Mr. HARROD is satisfied that there is nothing but encouragement to be found in the levee building experience of the last eight years.

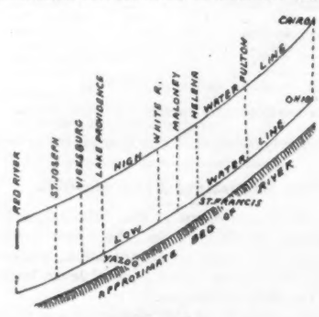


Fig. 3.

The Wynne System of Urban Electric Traction.

[From an English Correspondent.]

It is now about a year since the Board of Trade issued regulations stipulating that in future all electric light cables throughout the United Kingdom should be placed underground, except in special cases, for which permission from that department must be obtained, and that those cables already carried overhead should within two years be also undergrounded. It would thus appear that for electric traction purposes only two distinct systems can be employed in England, one being the expensive principle of accumulator cars, and the other where the current is taken from an underground cable placed in an open conduit, which is an aggravation of the evils attendant on the use of straight rails in a crowded street. To obviate these difficulties, and to meet the Board of Trade regulations, Mr. FRANK WYNNE, of 5 Westminster Chambers, London, has devised a direct system of electric traction, which avoids either the use of an open conduit or an overhead conductor. The scheme is not entirely new, as a Mr. WHELESS, of Washington, has already projected a somewhat similar system adapted to "series" working. In addition to this the late Prof. FLEEMING JENKIN and Profs. AYRTON and PERRY suggested, some time ago, the employment of similar underground and sectional conductors, while the plan of "picking up" or raising the current underground without a slotted conduit has already been projected by Messrs. BINSWANGER, POLLAK and others.

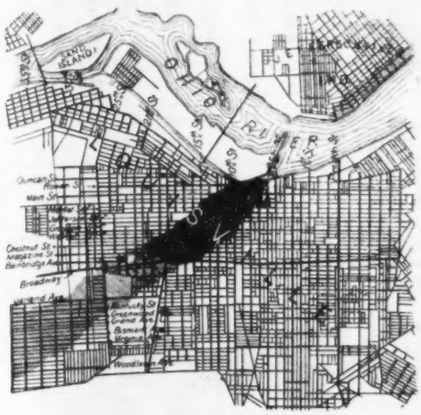
In Mr. WYNNE's system there is laid in the centre of the track a crenelated contact plate or rail in short sections. This contact plate is not straight. On the surface the plate is half an inch wide and about 4½ in. deep. It is claimed that it offers no obstruction to vehicles crossing the track, and that it affords a good foothold for horses. The sections of the centre rail are successively put in connection with the insulated cable as the car passes over them, and are disconnected as the car proceeds. The only contact plates in connection with the cable are those covered by the car and its platforms. Two sections are always in circuit, while a third may be momentarily so connected as the contact brushes carried by the car pass over one of the separating spaces. It will be evident that the sections must necessarily be short, and that the leakage is consequently greatly reduced. The contact boxes are preferably placed in the tramway track, although they can, if desired, be laid in the footway or curbs. The boxes, which are made either of cast iron or steel, with a grooved or diamond surface, are constructed on the diving-bell principle, so that the inclosed air will prevent water from rising in the interior. The device for making contact is rather ingenious. Below each contact plate, and in connection with the by-wire is an electro-magnet which is traversed by the current passing from the cable to the car motor, the current passing successively through the whole of the magnets. The armatures and contact makers are actuated severally by the electro magnets, and are contained in the contact boxes. As the car passes over the third section or plate, the current passing through the magnetic coil in that section not only closes the contact in connection with its own magnet, but also puts the next magnet in circuit in parallel with the third magnet. By the adoption of this arrangement sparking is avoided, and one section is always charged in advance of the contact brush. The contact pieces assume their original position by gravity, and the sections are thus disconnected as the cars leave them. The inventor has provided devices by which the circuit is maintained, and remade in case of accidental disturbance, such as the car leaving the rails. If the contact is accidentally broken the driver, by moving a lever, brings into action a supplementary contact brush, which closes the circuit of a single bell battery, which re-establishes the current through the contact boxes.

The inventor estimates that the capital expenditure for applying his system to any existing tramway amounts to $11,000 per mile of single track, as compared with $10,000 for horses and horse cars, the latter being the expenses on the North Metropolitan Tramway Co.'s lines. The sum of $11,000 includes boilers, engines and dynamos of twice the power required, but not the cost of real estate and buildings, which in the case of an electrically worked line is less, owing to the smaller space required as compared with that for the accommodation for horses and cars. Mr. WYNNE estimates the cost of power per mile run to be three cents (1½d.). This figure includes coal, oil, waste, water, engineers, firemen and dynamo attendants, with depreciation at 7½ per cent. per annum on half the generating plant. The inventor claims that his system secures all the advantages of an overhead conductor service, without the constructive disadvantages of an open conduit.

The Louisville Tornado.

We give in the accompanying small map of the city of Louisville as accurate an indication as we can deduce from the conflicting accounts of the path of the tornado across the city. This path is shown by the hatched area, the small portion in solid black

being that where the violence of the storm was greatest. It will be seen that this last area was hardly more than 3 per cent. of the total area of the city, but unfortunately it was in the very heart of the city, so that it included much more than 3 per cent. of the buildings and population of the city. The maximum of violence was reached just before the tornado struck the river. In passing the river it lashed it into a white foam, but after it struck Jeffersonville its violence was much diminished. Fortunately the great Ohio River bridge at Louisville lay below the direct path of the storm. Otherwise there can be little doubt that the ironwork, if not the piers also, would have come to a speedy and untimely end.



The Louisville Tornado.

[The map shows the entire area of Louisville, which is laid off in streets. The hatched area shows the path of the tornado, and the solid black area (which is about 3 per cent. of the total) that where the destruction was serious, the northeasterly half of this area being where the greatest violence was shown, and the greatest loss of life occurred.]

The fatalities have not proved to be as numerous as was at first feared and reported; 93 deaths and 150 serious injuries exhaust the Louisville list, but about half as many more casualties have occurred in the neighboring towns and cities. The storm, while one of great violence, is notable chiefly as having struck so many populous centres. Otherwise it is not without many precedents.

We also reproduce herewith a very interesting chart showing the distribution of all recorded tornadoes in the United States from 1794 to 1881, to which we have added a line of alternate circles and dashes, showing the path of the storm centre of the late great storm across the continent. The position of the storm centre on the morning of each of the three days which it occupied in its journey across the continent is noted along the line. The storm started in Utah on Wednesday morning. Thursday night it was central near Springfield, Ill., at which time the great tornado occurred, and two days later had passed off into the Atlantic Ocean. Tornadoes always occur, if at all, to the southeast of the storm centre.

This map was constructed by Lieut. JOHN P. FINLEY, of the U. S. Signal Corps, whose researches have added greatly to the knowledge of these phenomena. We reproduce it from Gen. A. W. GREELY'S admirable volume on "American Weather." Gen. GREELY neglects to state the precise basis on which this map was compiled, unfortunately. We surmise, but surmise only, that the basis was the number of tornadoes reported for each separate county. It certainly does not mean that each separate spot on the shaded areas has been visited by tornadoes 5 to 50 times since 1794, since this would exaggerate many hundred fold the real danger of tornadoes, as we have pointed out more fully on our editorial page, to which we refer for further particulars.

As an indication of relative frequency, however, the map is no doubt fairly trustworthy, although even in this respect it must be studied with some grains of allowance. The singular immunity of Indian Territory, for example, while in part it may be actual, is probably in larger part due to imperfection of the returns, and the same may well be the case for various other thinly populated regions. In the timber districts of Southern New York and Pennsylvania it is a very common thing to see the tracks of past tornadoes indicated by narrow lanes of fallen trees, usually 100 to 150 yds. wide, as straight and sharply cut as if by the hand of man, all the trees within the lane being blown over by the roots, large and small, and all the trees outside of its edges being entirely uninjured. These furrows preserve the records of perhaps a century on the spot in question, the older ones, of course, being gradually filled by a second growth, and the total area thus laid low is a most insignificant fraction of the whole, certainly not a tenth of one per cent., though the region named is shown by the map to be quite subject to tornadoes. These furrows at points cross each other nearly at right angles, and their frequency is a good deal influenced by the local topography.

The Drainage of the City of Mexico.

In a late issue a correspondent of *Le Genie Civil* gives some interesting data relating to the drainage of the City of Mexico, the contract for which is now under way. Omitting the introductory, which carries the history of the enterprise back to 1607, and has already been published several times in this journal, an outline of the present plan will be of interest.

The writer says that the entire drainage of the Texcoco lake, as planned by M. GARAY, has practically been abandoned owing to the grave dangers likely to follow from the exposure of this vast area of lake bottom covered with the accumulated filth of centuries from Mexico. The plan is now to simply lower the lake level and hold it at a point which will not endanger the city, and to carry away the water falling in the five rainy months. To this outflow must be added the volume of sewage water coming from the San Lazaro Canal.

During the seven dry months of the year, when the main canal only receives the volume from the San Lazaro canal, it will be possible to drain the lakes of Xaltocan and San Cristobal, north of the city, and in part the waters of the lakes Chalco and Xochimilco, lying to the south of Mexico.

In formulating the plans, the extreme variation in the level of Lake Texcoco, from the beginning to the end of the rainy season, was estimated at 0.7 m. (2.3 ft.), and the total wet area was taken at 272,170,803 sq. m. On this basis the volume of water to be removed during the five months of the rainy season is 190,519,562 cu. m. (6,725,340,539 cu. ft.); this means 53 cu. ft. per second. As regards evaporation, the writer says that it is believed that the figure given above is really somewhat less than is annually received by the lake. On the other hand, it is feared that in a very dry year the lake may dry up entirely, as it did in 1877; but to prevent this means have been provided for turning into Texcoco the waters of Lake Chalco, in sufficient quantity to meet sanitary requirements.

The main canal from Mexico to the head of Lake Texcoco, is 12.4 miles long, and receives the 5 cu. m. per second of sewage from the San Lazaro canal. The continuation of the main canal from Texcoco north, is 17.4 miles long, and carries the water of the first section and the surplus of Lake Texcoco as well; the latter being definitely fixed at 61.77 cu. ft. per second to allow for filtration.

The open canal, or Grand Canal, starts at the Gate of San Lazaro at a level 7.4 ft. below the zero adopted by the drainage commission, which zero is 32.8 ft. below a line tangent to the lower edge of the Aztec calender stone fastened to the west wall of the Cathedral. This Grand Canal traverses lakes Texcoco, San Cristobal, Xaltocan and Zumpango and meets the tunnel at a level 26.01 ft. below the commission zero. The total length of the canal is 29.84 miles, with a fall of 0.0002 per m. and a side slope of 45°. For the first 12 miles it has a width of 16.40 ft. at the bottom; a depth of water of 4.6 ft., and a mean velocity of 1.8 ft. per second. The second section has a width of 21.32 ft. on the bottom; a depth of not exceeding 8.2 ft., according to the season, and a mean velocity of 2.64 ft. per second.

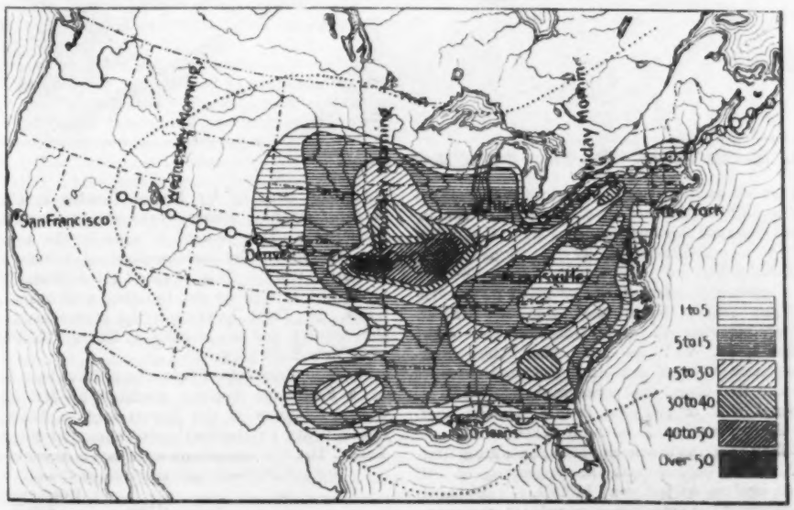
The quantity of material to be removed is as follows:

	Cu. Yds.	
Gate of San Lazaro to head of Texcoco		2,301,756
Head of lake to tunnel entrance		13,220,878
		15,522,034
Deduct work done by the Bucyrus Co.	1,308,000	
" " " Commission to June 30, 1888	747,900	2,055,900
Total remaining to be done		13,466,674

The Bucyrus Construction Co. is an American company which has confracted with the Committee of Works for the removal of 1,308,000 cu. yds. of material on the second half of the canal. The earth removed is to be deposited on each side of the canal, with a natural slope forming a bank with its toe about 33 ft. outside the edge of the canal.

The most important part of this work will doubtless be the tunnel of Tequixquiac (for section see ENGINEERING NEWS, Aug. 10, 1889). This tunnel will be 31,229 ft. long (9,521 m.); but it may be prolonged 1,800 ft. or more toward the south, for the junction with the canal ought not be more than about 80 ft. deep. The tunnel has a fall of 0.001 m. per 1,000 for the first 9,000 m., and 0.00135 for the last 521 m. The sill of the tunnel, at its exit, is 82.66 ft. below the level of the Grand Plaza in Mexico. A map of the canals, profile and section of tunnel, and some further details of the earlier history of this work, will be found in ENGINEERING NEWS.

The section of the tunnel is ovate, with a vertical diameter of 17.7 ft. and a width at water-level of 12.88 ft. The area is calculated for a flow of 61.70 cu. ft. per second, with a mean velocity of 7.54 ft. per



Distribution of all Recorded Tornadoes in the United States, from 1794 to 1881.

[From a map prepared by Lieut. JOHN P. FINLEY, U. S. Signal Corps. The path of the storm center of the late storm across the continent is also shown by alternate circles and dashes, with the position of the storm center on the morning of each day, from Wednesday morning, March 26, when it was central at Salt Lake, to Friday morning, March 28. The Louisville tornado occurred on Thursday evening, March 27, when the storm center was at Springfield, Ill. The outer limits of the storm are indicated by the dotted line, which includes most of the United States and Canada.]

second. The arch masonry will be in brick, and the lower two-thirds, in depth, will be built of common basaltic stone masonry, lined with about 6 ins. of Portland cement mortar or artificial stone. The general thickness of both classes of masonry will be 1.47 ft. To carry on the work 24 shafts will be sunk on the line of the tunnel, of which ten are finished The shafts will all be lined with masonry.

On Sept. 10, 1888, the Commission contracted with the London Mexican Prospecting & Finance Co., Limited, for a loan of £400,000. This company has undertaken to do the work on the tunnel under the following conditions:

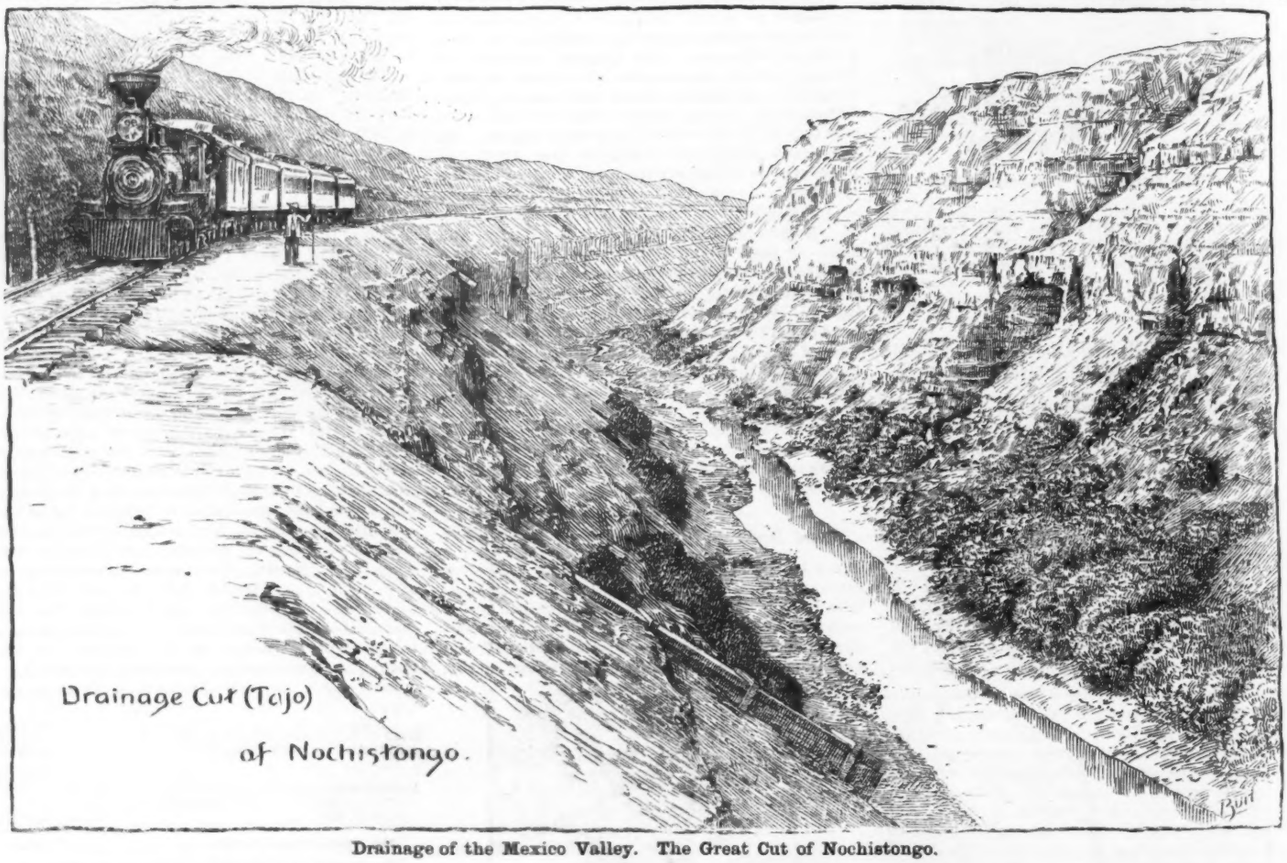
Lineal metre of tunnel heading	$ 12.53
" " " arch work	125.36
" " " bottom	112.82
Lineal metre of tunnel	$250.71
" foot of tunnel	76.43

[NOTE: These prices are probably given in Mexican money, which is now at a discount of about 33 per cent.—ED.] This tunnel was commenced on March 25, 1889, and is to be finished by Sept. 25, 1891. A premium of $300 per day is offered for any advance on this date, and a like sum to be forfeited for failure. It is expected that the entire drainage work can be completed in five years.

The sewers of the City of Mexico consist of a network of covered channels 2.46 ft. wide by 2.79 ft. deep, situated sometimes in the middle and sometimes on the sides of the streets; these communicate with the houses by pipes and receive the rain-water and the household filth of all kinds. These channels, almost always gorged, communicate with a system of secondary sewers which empty into a collecting sewer and thence into the canal of San Lazaro, which transports the water with all its detritus to Lake Texcoco. But if the water is high in the lake, this water backs up into the sewers and saturates the soil under the houses and the streets. As this condition of affairs has been existing for several centuries the condition of the subsoil of the City of Mexico can be better imagined than described. As one dire consequence, the death-rate of Mexico touches 40 per 1,000, the highest in the civilized world.

As an immediate remedy to this back-water danger, Mr. ROBERT GAYOL, C. E., one of the engineers for the Commission, will at once install, near the Gate San Lazaro, a pumping plant with a capacity of 5 cu. m. per second. The sewage will then be collected in a well and pumped over a dam, cutting off the San Lazaro canal from the sewers. The city will thus be free from the oscillations of the waters of the lake, and yet be enabled to clear its sewage channels.

Some further details of the great Nochistongo Cut are, owing to lack of space, held over for publication in next issue.



Drainage of the Mexico Valley. The Great Cut of Nochistongo.

The Cost of Working Passenger Traffic in England.

Mr. GEORGE FINDLAY, who, lately published a very elaborate paper illustrating the comparative cost of working the first, second and third class passenger traffic on English railways, has prepared a supplementary paper, extending the analysis to eight of the English railway companies. The working expenses are worked out for the year 1888, as well as for the year 1871, so that an opportunity is afforded of comparing the increased or reduced percentages for the two periods. As in his original paper, Mr. FINDLAY bases the apportionment of the expenses on the seat space provided in the carriages of the different classes. The result shows that in the case of each of the companies the increase of great accommodation has been in excess of the increased demand; this fact, together with the reduction of fares, increased train service, higher speed, the development of season-ticket and suburban traffic, generally affected the average gross earning "per seat." From the table of percentages of working in each class of the eight companies, it will be seen that the working expenses absorbed more than the whole receipts from the first-class, the percentage being 102, as compared with 58 per cent. in 1871. On the Sheffield the percentage is as high as 211 per cent., or more than twice as much as the receipts from first-class. In the second-class the percentage of 1888 was 69, against 50 per cent. in 1871. In the third-class the working expenses were only 41 per cent., as against 39 in 1871. The increase of expenditure of 9 per cent., bringing the total to 50, has been unproductive to the companies, for while, in 1871, 59 per cent. of the gross receipts were secured as profit only 50 per cent. now passes to the net revenue account. As a general result of the improved service and lower rates of the railway companies, the passenger traffic now requires 53 per cent. of the gross receipts, while in 1871 the proportion of working expenses to receipts was only 48 per cent. The following table shows the varying conditions on which the passenger traffic is worked by the several companies:

PERCENTAGE OF WORKING EXPENSES PER CLASS TO GROSS RECEIPTS PER CLASS.

	First.		Second.		Third.		Total.	
	1888.	1871.	1888.	1871.	1888.	1871.	1888.	1871.
Company.	Per cent.		Per cent.		Per cent.		Per cent.	
Great Eastern	139	62	71	69	34	34	53	51
Great Northern	94	58	63	42	53	43	60	47
Great Western	109	59	54	51	39	28	48	44
North Western	92	53	73	52	42	36	54	46
Brighton	76	46	69	47	30	53	47	49
Sheffield	211	71	233	55	35	44	57	51
Midland	111	63	—	43	42	54	53	52
North Eastern	101	72	127	49	48	36	57	47
Mean	102	58	69	50	41	39	53	48

—London *Railway News.*

A New Portland Cement.

A new brand of cement, known as the Stettin-Gristower Portland cement, is being introduced into this country by Eugen Kanter & Co., of Berlin, Germany, whose works are at Cammin, in Pomerania. This cement is used by the German government in the construction of fortifications and other works. It is adapted for artificial stone pavement as well as for building and other purposes. Mr. EMIL KANTER is the representative in this country, and has an office at Room 8, 252 Broadway, New York City.

The following tests of this cement have been made on a Fairbanks testing machine by Mr. N. O. OLSON, Engineer of the Department of Tests and Experiments, Fairbanks Co., 84 Thomas Street, New York. The test specimens were seven days old.

Tests of Stettin-Gristower Portland Cement.

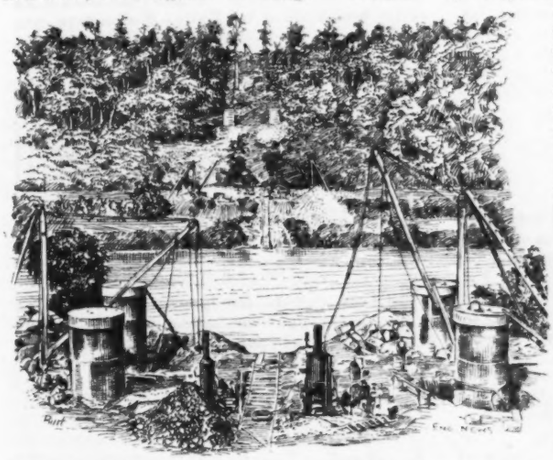
	Neat.	1 part cement, 2 parts standard sand.
Water used	25 per cent.	12½ per cent.
Time in air	24 hours	24 hours.
Time under water	6 days	6 days
No. of briquettes	10	10
Shape	standard	standard
Average strength	654 lbs.	277 lbs.

The Kentucky River or Tyrone Cantilever Bridge.

(WITH INSET.)

The Lexington extension of the Louisville South ern Ry. crosses the Kentucky River at Tyrone, Ky., on a steel cantilever bridge, which is the longest and highest yet erected in America. In the early part of last year the railway company contracted with the Union Bridge Co., of New York, to design and construct the superstructure, and with Hopkins & Co., for the cylinder foundations, the latter being from the plans of Mr. JOHN MACLEOD, C. E., Chief Engineer of the railway company. To the courtesy of the Union Bridge Co. we are indebted for the drawings from which our cuts are made, and to Mr. JOHN N. OSTROM, C. E., engineer in charge of erection, for the following brief description of the work on the super-structure.

Kentucky River Bridge; Aug. 31, 1889. Elevation of Completed Structure.



Kentucky River Bridge; June 12, 1889. Showing Tower Foundations.

The original plan contemplated the erection of the cantilever spans first and following them with the approaches; the material was also to be hoisted from barges loaded at Frankfort, Ky., the most convenient railway terminus. But owing to some unexpected delay in completing the cylinder foundations, resulting from the controversy with the contractor, this plan was reversed, and the approaches were first built.

The material for the west approach was hauled to the track level and erected by overhanging deck-travelers, working from the abutment toward the anchor tower. Falseworks were next erected for the west shore arm of the cantilever, building out from the anchor to the main tower with an overhanging traveler, which was replaced by a heavier traveler for the erection of the main tower. Upon the completed falsework a through traveler was set up, with the legs straddling the arm in the usual manner, but with two tracks on each side instead of one.

When the main tower was built work was commenced on the shore arm of the cantilever, commencing, of course, at the tower and carrying it forward to the coupling with the anchor tower. All material was hoisted at the main tower to the level of the traveler track, and then run back on push cars to the traveler and hoisted into place. After the shore arm was coupled to its anchors, the split-traveler was taken down and a deck overhang traveler was built for the erection of the river arm of the cantilever and half of the suspended span. All material for the river work was hoisted directly from barges, as contemplated in the first plan.

While work was in progress on the west side of the river, the east approach and shore arm were commenced and carried forward in a similar manner to that already described, excepting that the traveler used in erecting the falsework of the shore arm of the cantilever was made strong enough to build the main towers, thereby gaining time. Another point of difference was that the material for the east viaduct was hauled up hill on an inclined railway by a hoisting engine.

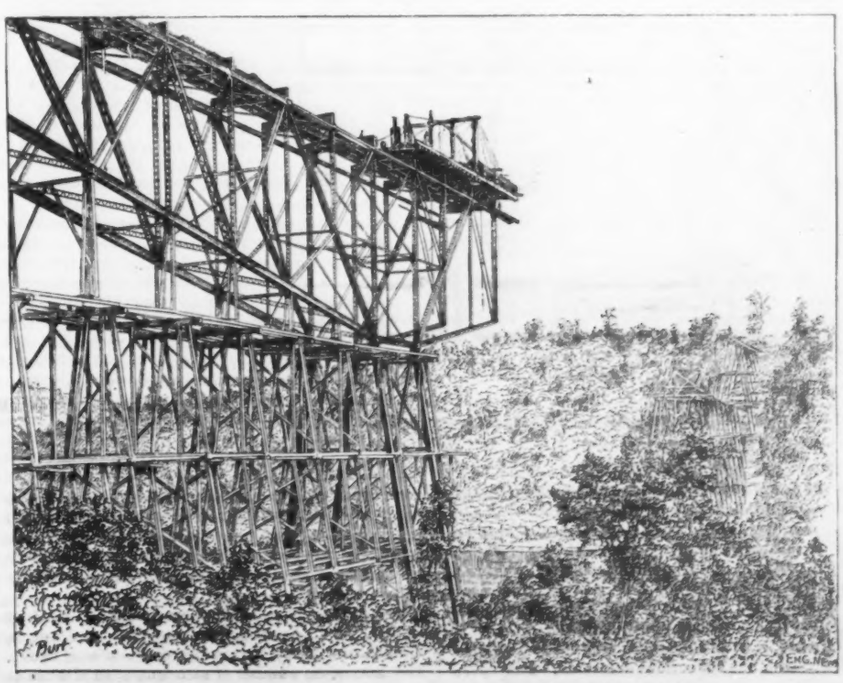
The coupling at the centre of the suspended span was easily and rapidly accomplished. Before the east half of the suspended span was commenced, the opening to be closed was accurately measured by a suspended tape, and the adjusting apparatus was so set that the bottom chord should slightly overlap, leaving an opening at the centre joint of the top chord. The apparatus was so nicely adjusted that it was only necessary to slightly raise the ends of the bottom chord bars to permit the driving of the centre pin, which work was completed in about 15 minutes for each side, without touching the adjusting machinery meanwhile. When the centre section of the top chord was swung in place an opening of 1¼ ins. remained; and to close this, the adjusting apparatus was released and the arm sank quickly into place. While performing this work the working traveler was on the east half of the suspended span, and the adjusting machinery on that side was not released. This adjusting machinery was one of the most important and interesting features connected with the erection of the bridge. It was designed by the Union Bridge Co., and is shown in the accompanying sketch. The wedge, being fixed between rollers, well in toward its heel, raised the centre of the suspended span above the final positions. Consequently, to make the centre connection it was only necessary to slacken the adjustment nut, to allow the weight of the suspended span to force out the wedges and the centre sunk into place. It was also possible to arrest the lowering of spans at any point or instant of time. Baird Bros., who had the contract for erection under the Union Bridge Co., rearranged the machinery to one form here shown, by wisely putting the frame on top of the upper chord, to obviate the necessity of an extra swinging platform for the men; but the same arrangement could not be made for the lower chord. The wedges in both frames were so arranged that screwing up on the nuts pulled the wedges from between rollers. Safety blocks, of wood, were placed in the frames to prevent the possibility of the wedges starting before the proper time. When these blocks were removed, a very slight turn on the nuts overcame the quiescent friction; the wedges popped out from between the rollers, and the centre of the suspended span dropped to a bearing. The sudden drop was undesirable, and in future apparatus of this kind it will be so arranged that the wedges may be drawn out and stopped at pleasure, thus keeping complete control of the suspended span.

The comparative time occupied in erection on the east and west side is shown in the following table of dates:

SCHEDULE OF DATES OF ERECTION.

West Half.

Feb. 20	Foundations begun—about	
June 29	" finished.	
" 3	Began erecting west approach.	
" 11	Finished " "	
" 24	Began erecting west main towers.	
" 28	Finished " " " "	
July 10	Began " " 208 arm.	
" 19	Finished " " " "	
" 29	Began " " 130 "	
Aug. 2	Finished " " " "	
" 2	Began erecting west half 260 (susp.) span.	
" 5	Finished " " " " " "	



Kentucky River Bridge; July 31, 1889. Falseworks and West Shore-arm.

East Half.

July 18	Began erecting east approach.
" 23	Finished " " "
" 31	Began erecting east main towers.
Aug. 4	Finished " " " "
" 7	Began " " 208 arm.
" 13	Finished " " "
" 15	Began " " 130 "
" 17	Finished " " " "
" 17	Began erecting east half 200 (susp.) span.
" 19	Finished centre couplings.
" 24	Crossed first train

The erection of west side progressed slowly for several reasons. In the first place, the contractors for foundations and for erection were on the ground at the same time, and since the erectors came last it was not possible to place the plant in the most advantageous position until foundation work had been completed and its plant removed. Besides this the top traveler for overhanging portion, was an old one used at Poughkeepsie, which was cut down considerably and which took as much time as would have been required to build a new one. Men were scarce or this work would been begun earlier, and completed before the traveler was needed. On the east side the erection was very rapid as the erectors had the whole ground, the travelers were all ready to go up rapidly, and the organization of men had been skillfully perfected.

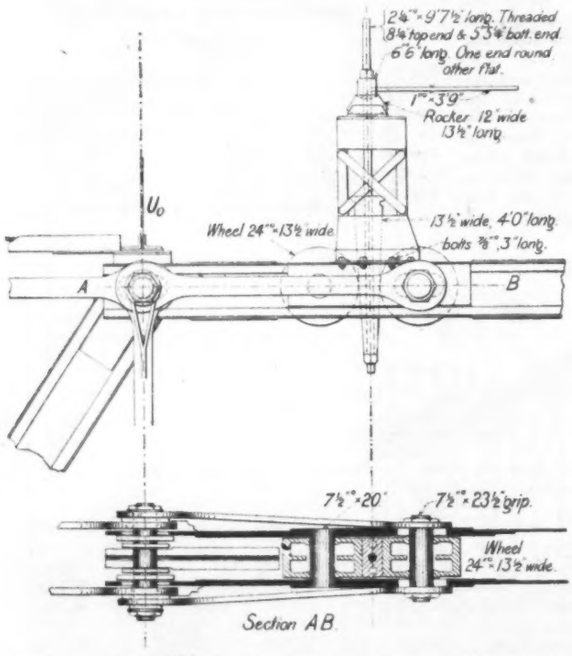
Not a life was lost; but there was quite a number of distressing but not serious accidents. The speed of erection was very much facilitated by the accurate fitting of the work, and the precision with which centres of foundations were located, so that very little fitting and adjusting was necessary.

The greatest item of time in erection was the construction of travelers and falsework for shore arms. A traveler was erected for west approach, which was taken down and erected for hoisting falsework for west shore arm, and in turn another was set up to erect main towers. Then a through traveler was constructed to erect the shore arm, and a final deck traveler was used for the river arm and suspended span. One deck traveler could have been used for shore arm—and for river arm by modification of track—by running falsework to top of truss; but this increase in height of 60 ft. meant a large increase in the bill of timber, besides obstructing to some extent the hoisting of material, which must have been passed through the falsework to swing into position; but the plan had been tried and found less economical than to put up a through and a deck traveler. However, the problem in the future is to reduce the material in falsework and to simplify travelers.

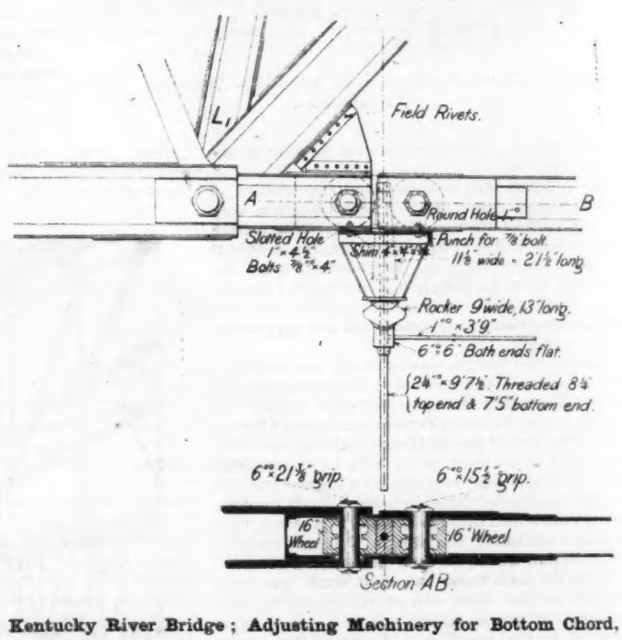
Under each shore arm were 250,000 ft. B. M. of timber. Four hoisting engines were used, one on the deck and one on the ground, east and west banks. The maximum number of men employed was about 135, and the minimum number 65. The bridge was absolutely required by the railway company to carry a train on or before Aug. 29, in order to save the Lexington subscription. The Union Bridge Co. promised it on Aug. 25, and delivered it practically finished for the first train on the 24th, the time of construction and erection being about six months.

Including foundations, the total time from breaking ground to completion was about seven months. It should have been stated earlier, that while the eye-bars were made at the Athens shops of the Union Bridge Co., the remainder of the shop work was sublet to the Detroit Bridge & Iron Works, and a proportionate share of credit for accurate workmanship is due to this company.

Kentucky River Bridge; Approach Viaduct.



Kentucky River Bridge; Adjusting Machinery for Top Chord, Joint U_0.



Kentucky River Bridge; Adjusting Machinery for Bottom Chord, Joint L_1.

Foreign Immigration.

The records of Castle Garden, which is about to be abandoned as the official emigrant landing place in favor of an island in the harbor, extend back to May 5, 1847, the date of the organization of the Board of Commissioners of Emigration. Since that time nearly 10,000,000 immigrants—the exact number to Jan. 1, 1890, is 9,639,635—or about one-sixth of the entire population of the United States, have been landed there. The following table shows the countries whence the aliens came, and their numbers.

	No.	P. c.		No.	P. c.
Ireland	2,541,148	26.3	Spain	19,215	0.2
England	1,178,157	12.2	Portugal	2,295	—
Wales	60,033	0.6	Denmark	123,933	1.3
Scotland	277,766	2.9	Hungary	131,746	1.4
Germany	3,425,208	35.6	Austria	109,632	1.1
France	170,320	1.8	Bohemia	76,457	0.8
Russia	224,559	2.3	China	3,151	—
Poland	18,244	0.2	Australia	606	—
Switzerland	172,780	1.8	Turkey	1,834	—
Sweden	325,851	3.4	Greece	2,044	0.1
Norway	173,041	1.8	All other countries	162,173	1.7
Belgium	29,469	0.3			
Holland	89,381	0.9			
Italy	317,192	3.3	Total	9,639,635	100.0

The bulk of all the immigration into the United States, except that from Canada, arrives at the port of New York. The Canadian immigration since 1847 has been at least 1,000,000, or 10 per cent. of the foreign immigration. Keeping this in mind, it will be seen that nearly one-quarter of the immigration to this country is of the English, Scotch or Welsh race, about another quarter Irish, and a third German. The undesirable classes of immigrants, Poles, Italians, Hungarians and Bohemians, constitute altogether less than 6 per cent. of the total, and not all of these nationalities, by any means, are undesirable.

Making Welded Steel Water Pipe.

The substitution of steel for cast-iron waterpipe of large diameter is often a necessity growing out of the enormous excess in weight of the cast iron and the difficulties and cost of transportation. A steel pipe of one-quarter of the weight of a cast-iron pipe of the same efficient diameter will withstand a greater internal pressure, and from its material is much less liable to breakage in handling. On the Pacific Coast riveted iron pipes have long and successfully been used for the conveyance of water under pressure, and an experience of over 20 years has shown that when properly coated with SMITH'S compound or other preservatives, the fears of their rapid corrosion are to a great extent groundless.

A process has lately been invented by Mr. ROBERT CARTWRIGHT, C. E., of Rochester, N. Y., for welding this pipe instead of riveting it, thus reducing the amount of skilled labor to a minimum, and by machinery making the operation automatic and continuous, with a corresponding reduction in cost.

The plant for performing this work is illustrated in the *Iron Age* of March 20. Briefly described, the operation of the device is as follows: The general features of the machines are two compound air and gas furnaces, one internal and one external, immediately in advance of internal and external rolls, all being mounted on a frame to which a reciprocating motion is imparted by a crank, the seam of the sheet being welded being drawn between the furnaces and rolls as the weld is made. The gas and air are supplied through pipes attached to the reciprocating frame; and as their rear ends are joined to rubber hose, the movement of the frame is made possible. The sheet having been rolled to the required diameter, is held rigidly in shape by suitably designed removable clamps on the outside and compression rings on the inside immediately under the clamps. These clamps and rings are quickly removed as the weld advances and without requiring the stoppage of the work. In starting to weld a seam the blow-pipe jets of the furnaces heat the material, and as the pipe is drawn in the part longest in the flame comes to welding heat and is brought between the rolls and closed down to a perfect weld, the rolls being adjustable to suit different thicknesses of material.

These pipes are to be connected by a "hub and spigot" joint, in which the hub end is "spun" out to an interior profile suitable for holding the gasket and the lead joint; and the spigot end has an outward turned lip taking the place of the "bead" on the old cast-iron pipe. A steel band or ring is used to reinforce the hub and to counteract the upsetting tendency of the lead in driving the joint. This joint is so made that the interior diameter of the pipe is preserved constant and smooth throughout.

Industrial Troubles During the Last Nine Years.

In reviewing the industrial outlook, *Bradstreet's*, of March 29, shows by the diagram here reproduced that 1889 was one of the least disturbed years for some time past. For the present year the strikes have been more frequent, but the numbers involved are smaller than in the corresponding period of 1889.

NUMBER OF INDUSTRIAL EMPLOYES STRIKING OR LOCKED OUT ANNUALLY FOR NINE YEARS.

Year.	*Number.*
1881	130,000
1882	158,000
1883	170,000
1884	165,000
1885	258,000
1886	600,000
1887	380,000
1888	233,000
1889	210,000

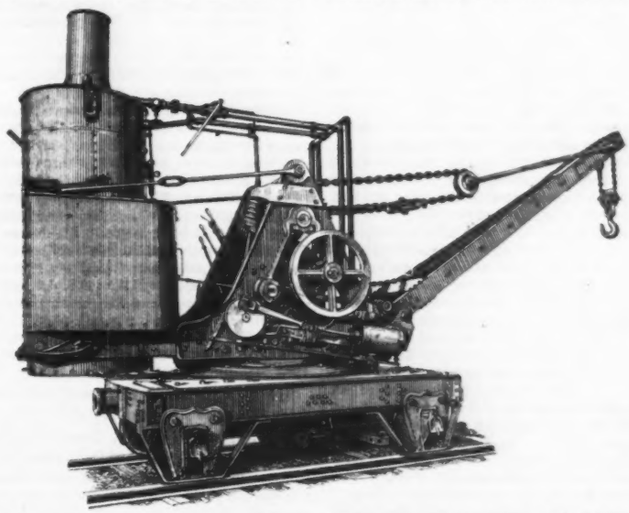
In the above diagram the figures from 1881 to 1886, inclusive, are taken from the statistics of the Government Bureau of Labor, while the figures for the last three years are estimated upon the basis of reports to *Bradstreet's*.

Five-Ton Portable Steam Crane.

The accompanying illustration shows a type of crane recently constructed by the Industrial Works, of Bay City, Mich., for use in and about manufacturing establishments, freight yards and stations. The machine is self-propelling, and its uses as a crane are greatly increased by being able to transport itself, together with its load, from one point to another. The load is balanced in all positions by the boiler, water tank and coal box, all of which are bolted to a platform attached to the rear portion of the A frames.

To the A frames is attached a double engine, one cylinder on either side, and power is given for hoisting loads, slewing the crane a complete circle, varying the radius of the jib from 8 ft. to 16 ft., and propelling the car upon which the crane is mounted. All motions are entirely independent. Hoisting and slewing may be performed at the same time, and propelling in any position and at any time.

The materials of construction are most substantial; the gearing being of steel or bronze and all shafts running in bronze boxes. The centre pin is of forged steel, made hollow to allow the passage of the propelling shaft, which connects with the axles of the driving wheels. A steam pipe also passes through the centre pin, supplying a steam brake which is easily and quickly handled by the operator. The feature of varying the radius of the jib is often very convenient, as it may extend or contract to get a fair lift upon an object, and also may place the load precisely in the position required. The boiler is of the best construction, with submerged flues and flanged doors. It is neatly covered with a lagging of asbestos, wood, and Russia iron. All motions are controlled by one operator, standing between the boiler and the frames.



A 5-ton Portable Hoisting Crane; Industrial Works, Bay City, Mich.

A crane of this type was recently supplied to the Northern Central Ry. Co. for handling heavy freight in and about their freight stations. The capacity of the machine is only limited by the stability of the car; and where necessary, projecting beams and jacks are provided for adding stability for heavy side lifts. The Industrial Works have in constant use about their establishment a machine similar to the illustration, and for transferring heavy castings, beams, or heavy freight from one point to another, they have found it invaluable, not only in saving labor, but also in rapidity of work. It also serves the purpose of a small locomotive, and several 4-wheeled cars common in manufacturing establishments can be loaded and shifted with ease. Cranes of this type of greater capacity than that above described have been made by these works; some designs having a lifting capacity of 10 and 15 tons, and they are now at work upon a machine for lifting and slewing weights of 25 tons. Mr. WM. L. CLEMENTS is the engineer of the company.

Field-Book Notes.

[We have been compelled, for unavoidable reasons, to postpone the continuation of the matter from Mr. WELLINGTON'S forthcoming Field-book relating to transition curves. It will be continued next week. In the meantime, we give the following communication, with notes, relating to matter previously published.]

Mr. O. A. VEASEY, writes from Dego, W. Va.:

I venture to offer a few suggestions concerning your "Manual of Railway Field Work." I do not only heartily concur in what Mr. BURGESS has to say in ENGINEERING NEWS of Dec. 28, concerning the table of functions of a 1° curve, but go further, and say that this table should be extended to at least 120°, and if it went to 180° it would be so much the better. In my opinion, the most useful table for a locating engineer, that has ever appeared in any field-book is Shunk's table of the functions of a 1° curve. It alone is worth, I had almost said, ten times the price of the book.

[The author has concluded to extend the table of functions of a 1° curve to 120° instead of stopping at 100°, but believes that a two-page table for each function, giving values for every even 10', with parallel difference columns at the side giving interpolation values for 1' to 9', is better for the user of the table than to extend the eight pages thus required for the four functions to sixty pages in order to give every second minute *without* differences; or to the one hundred and twenty pages required to give each single minute.]

In regard to other tables, I think the table of radii of curves should begin with 1° curve and proceed by single minutes to a 10° curve, thence for every 2' to a 16° curve, thence for every 4' to a 24° curve, thence for every 10' to a 32° thence for every 20' to a 40° curve and thence by ½° to a 50° curve.

[This is precisely what is proposed, except that the single minute differences will stop at 8°, not 10°; the 2' differences at 24°, not 20°; thence 5' will be used up to 40°; and thence 10' up to 64°, or to a radius of 89.53 ft. By this arrangement 1,296 different radii and their logs are given in 6 pages with some space to spare for notes; whereas Searle's, the fullest table in existence, gives only 1,008 radii on 8½ pages, the difference being due in part to the use of 5-place instead of 6-place logs, and in part to the omission of tabular tangent offsets and middle ordinates, which are given at once by the formulas $O = \frac{7}{8} D$, and $M\text{-}O = 0.22\,D$, or more exactly, $0.218\,D$.]

The radii should be calculated not upon the basis of *chords* of 100 ft. but *arcs* of 100 ft. A table of curve formulas, such as Searle's Table No. III, would be very handy.

[The radii will be calculated as announced, for 100 ft. chords up to 8°, 50 ft. chords thence to 16°; 25 ft. chords thence to 32°, and 10 ft. chords thence. In either case *shorter* chords than this may be freely used without sensible effect on the radius, so that the radii will be practically according to length of arc, not chord, as they should be, and in practically exact ratio to degree of curve, but to compute the tabular radii in that way would not be best. A table of curve formulas is included.]

So long as spirals, easement or transition curves are not used, the letters P. C. for point of curve, and P. T. for point of tangent, are of course the standard symbols for these points.

[In any case those letters should be used. The transition curve merely makes an offset at the P. C. and P. T.]

Searles' table XIV, of grades and grade angles cannot well be improved upon; and is a very handy table for a field-book.

[This table can be and has been greatly improved. By arranging the "feet per mile" in ten columns, in the fashion of logarithmic tables, the feet per mile for each 0.01 per cent. of grade, from 0.01 to 10.09 per cent. are readily given on two pages, or over three times as much as Henck or Searles give in the same space; and by sub-

stituting the headings "Miles" and "Stations of 100 ft.," for the headings "Feet per station" and "Feet per mile," this (or any like) table serves as an extensive conversion table for stations into miles.]

As to what the majority of locating engineers think of tables of logarithms of numbers, sines, etc., in a field-book, I know not, but my desire would be that such tables be omitted, also tables of squares, square roots, cubes, cube roots, and reciprocals of numbers, and this space more profitably filled by a good traverse table, such as that given in Davies' Surveying.

[In this we think our correspondent (and one or two others who suggest the omission of logarithms) greatly err. Logs. are convenient for field use, and the tables of a field-book are also largely used for general office work. On the other hand a traverse table which does not extend to single minutes is almost waste space. The usual table of squares, cubes, square roots, cube roots and reciprocals extending to 1,000 is badly arranged. Cubes and cube roots are little used and will be omitted, except a single table (including also spheres) extending to 100; but a table of reciprocals to 1,000 on two facing pages, with differences at the side, is the most useful table without exception that a field book can contain, which yet is not indispensible; and a table of squares and square roots to 10,000, arranged logarithmically with side differences, will also be given.]

The New York State Commission on the Hamburg Disaster.

The full text of the Commission report on the Hamburg disaster of March 6, in so far as it relates to technical questions, is as follows: It is of especial interest as showing the cause of the brake hose pulling off, instead of parting harmlessly in the usual manner, and from its comments on the Cowell coupler.

Nothing unusual occurred until the arrival at Dunkirk. As the train was about to leave the station the Cowell coupler upon the first sleeper, the Salina, gave away; the train pulled apart about 4 ft. when the engineer stopped.

The coupler on the coach was of the Miller type, that on the sleeper the Cowell. These are what are known as the vertical-plane couplers and couple interchangeably.

The brakeman testifies that he pushed the knuckle of the Cowell coupler back into place, shook it to see that it was all right, and that it appeared so to him. The forward part of the train was then backed and the cars joined.

When the train pulled apart the two chains on each side of the coupling, which are intended to come into play if the coupling breaks, tore the staples from the car so that they were of no use. It also appears that the air-hose was pulled from the pipe on the day coach, in consequence of the *air* coupling having been frozen together by the drip from the *steam* coupling, so that no air could be transmitted to the rear sleepers and dining car. The car inspector appeared at this time with new hose, but Conductor Houghtaling refused to have it put on, saying that he had air on the six forward cars and that he would not wait to have the coupling replaced so that air could be given to the rear sleepers. Under this condition of affairs it was necessary to relieve the air from the rear sleepers, or "bleed" them, as it is termed. This left the automatic brakes on the five rear cars perfectly useless.

The board has made a careful examination of the Cowell coupler which gave way. It finds that the construction thereof is radically defective. The knuckle forming the hook is kept in place by a tongue which drops in front of an arm projecting into the drawhead from the rear of the knuckle, the whole knuckle pivoting around a pin. This tongue has a bearing surface upon the end of the arm of only about 2¼ sq. ins. An examination of it clearly shows where the pressure is brought to bear.

In this case the edge had been much worn and broken away, leaving the bearing very materially less than 2¼ sq. ins., and so slight as to enable the coupler to be jerked open. The portion of the edge broken was about 2 ins. long and ¼ in. high at the widest part, just at the place where the principal pressure came. Moreover, this tongue is not kept in place by any spring or device, but simply depends upon gravity. It is quite possible that a sudden jerk would raise it, so that the coupler would fly open. The Board deems that such couplers are in the highest degree dangerous, and should not be used.

Testing Car Wheels.

The New York *Sun* is responsible for the following interesting paragraph. Our impression is, however, that the facts as stated are correct:

Few railroad men, even, know how the universal practice of testing car wheels by sounding them with a hammer at stated intervals during the trip of a train came to be adopted. It had its origin in a most distressing accident. On July 26, 1846, while Middletown was yet the Western terminus of the New York & Erie R. R., a train left Middleton loaded with excursionists bound for a day's pleasure at the Elysian Fields, Jersey City, then a great pic-nicing resort. Car wheels were then made with iron spokes, after a plan devised by Ross WINANS. A wheel on one of these excursion cars broke while the train was running at a high rate of speed, not far from the present station of Monroe. Several cars were thrown down a high embankment. Several of the excursionists were killed and many were wounded. Captain JAMES LYTLE, conductor of the train, still living at Middletown, was thrown bodily through the partition of a compartment car without receiving so much as a scratch. Investigation into the cause of the accident led to the discovery that the broken wheel had been cracked for a long time. Thereupon an order was issued that every wheel on a train of cars should be tested at certain stations, and its soundness tested by a blow with a hammer. The accident and its cause attracted wide attention, and the testing of car wheels was adopted by every railroad in the country. The accident also put an end to to the Ross Winans spoked car wheel, and led to the introduction of the present style of chilled cast iron wheels.

The spoked wheel has continued in extensive use abroad up to this day, but there also it is passing out of use in favor of solid (*i. e.* unspoked) wheels. We have an impression, also, that the hammer test of wheels at stations, which is in use abroad as much as here, was of even earlier use in England. If any reader can give us the facts as to the introduction of the practice abroad, we shall be pleased to record them.

Plumbing in Small Buildings.

The following note is taken from the report for 1880 of Mr. WILLIS CHIPMAN, M. Am. Soc. C. E., City Engineer of Brockville, Ont.

Many people are prejudiced against placing a water closet in the house, presuming that foul odors and danger to health will follow shortly after its introduction. A careful estimate shows that in an average house built 10 ft. back from the street line, two stories high, the cost of putting in a soil pipe and house sewer will be about $60; a kitchen sink with waste, trap and vent, $15; water closet, tank, vent pipes, etc., $40; carpenter work, joiner work, plastering, painting, etc., $10; total, $125. A bath tub and wash bowl, although desirable, are not necessary; they can be added at an additional cost of about $40. In any building worth $1,000 an expenditure of $125 for putting in iumbing fixtures is not extravagant when we consider the danger to health avoided in winter by the use of water closets within a building, instead of outside privies, and in summer the improved sanitary condition of the premises, especially of the back yard and the rooms overlooking it. The floor space required in a building for a water closet compartment need not exceed 3 ft. by 4 ft., but that compartment should be well lighted and ventilated.

PERSONALS.

Mr. V. H. STEVENS, Superintendent of the Atlantic & Danville road, has resigned.

Mr. T. J. GARRETT has been made General Superintendent of the Atlanta & Florida R. R.

MR. JOHN S. HARDEN, Treasurer of the Western Maryland R. R. Co., died at Baltimore, Md., March 24.

MR. CREED HAYMOND, of San Francisco, Chief Counsel for the Southern Pacific Co. for some years, has resigned.

Mr. THOMAS CORNELL, President of the Ulster & Delaware and Kaaterskill railways, died at Rondout, N. Y., March 30.

Mr. J. C. LOOMIS, Superintendent of the Cincinnati Division of the Chesapeake & Ohio road, whose headquarters are in Cincinnati, has resigned.

Mr. ARCHIBALD A. SCHENCK has been appointed Chief Assistant Engineer of the New York Central & Hudson River R. R., under Mr. WALTER KATTE, Chief Engineer.

Mr. O. H. FRAZIER has been appointed Superintendent of the Cincinnati Division of the Chesapeake & Ohio road, being promoted from the position of Superintendent of Maintenance of Way, which position has been abolished.

Mr. E. C. NUTT, Jr., has been appointed Train Master of the Wyoming Division of the Burlington & Missouri River R. R. in Nebraska (owned by the Chicago, Burlington & Quincy R. R.), with headquarters at Alliance, Neb.

Mr. EPPES RANDOLPH, Chief Engineer, and Mr. E. HILGARD, Principal Assistant Engineer in charge of construction for the Covington & Cincinnati Elevated Railway & Bridge Co. and Chesapeake & Ohio terminals in Cincinnati, retired on April 1.

Mr. J. T. HARAHAN, late General Manager of the Chesapeake & Ohio road, has been appointed General Manager of the Kentucky Union road. The Kentucky Union has 36 miles of main line, and the company talks of building 25 miles more this year.

MR. E. SUMMERFIELD has been appointed General Manager of the Kansas City, Wyandotte & Northwestern R. R. and the Kansas City & Beatrice R. R., with headquarters at Kansas City. He will have charge of the traffic and operating departments of these companies.

Mr. W. F. ELLIS, Engineer and Roadmaster of the New York, Providence & Boston R. R., has resigned his position to accept one with the Dunham Mfg. Co. in the interest of the Servis tie plate and Davies spike, of which he has been a strong advocate, and was the first to suggest the combination of these devices as an improvement in permanent way.

MR. R. N. CAMPBELL has resigned as Superintendent of the Council Cluffs Division of the Chicago, Milwaukee & St. Paul road. He will be succeeded by MR. C. A. GOODNOW, formerly Superintendent of the Dubuque Division of the same road. MR. CAMPBELL goes to the Island of Jamaica to take the management of a railroad there. MR. J. T. HARTIGAN will succeed MR. GOODNOW.

Mr. DAVID DOWS died in New York, March 30. He was Vice-President of the Chicago, Rock Island & Pacific R. R. Co., and a director of the Union Pacific and Delaware & Hudson roads. He was a member of the firm of D. & A. Dows & Co., grain and provision dealers which gave its assistance to the government at the time of the war by negotiating loans and purchasing supplies.

Mr. H. L. MILLER has been appointed Superintendent of the Jeffersonville, Madison & Indianapolis Division of the Pennsylvania, in place of Mr. W. F. BLACK, resigned, to take the position of General Manager of the Louisville, New Albany & Chicago. Mr. W. B. LEEDS has been appointed Superintendent of the Southern Division of the Chicago, St. Louis & Pittsburg, in place of Mr. H. L. MILLER.

Sir JOHN FOWLER, best known to American engineers by his connection with the Forth Bridge, is 73 years of age. He commenced his pupilage with Mr. J. TOWLERTON LEATHER, a celebrated hydraulic engineer, and later was a pupil of Mr. RASTRICK on the construction of the London & Brighton Ry. In 1844 he was engaged with the Manchester, Sheffield & Lincolnshire Ry. Co. More recently he has been interested in the building of the Metropolitan Ry., the Metropolitan District, the Victoria & Pimlico, the Severn Valley, the Launceston & South Devon, the Isle of Wight, Birmingham & Stourbridge rail ways, and the Great Northern & Western Ry. of Ireland. He now has a wide practice as a consulting engineer, and is said to be in receipt of the largest engineering salary in England.

Mr. FREDERIC GRAFF, late President of the American Society of Civil Engineers, and one of the best known citizens of Philadelphia, died suddenly at his home in that city, on March 30, in the 73rd year of his age. Mr. GRAFF was born in Philadelphia, in 1817, and was the son of Mr. FREDERIC GRAFF, the Engineer of the Fairmount Water-Works in Philadelphia, and one of the most honored citizens of that city. Mr. GRAFF, Sr., was born in 1774, in the historic house at Seventh and Market streets, in which THOMAS JEFFERSON wrote the Declaration of Independence. He was an assistant engineer in the construction of the Centre Square, or first water-works of Philadelphia, and in 1805 was made the Superintendent of these works. When, in 1812, it became necessary to enlarge the water-works, and Fairmount was selected as the site of the new plant, Mr. GRAFF was put in charge, and for his designs and under his superintendence the new works were completed in every particular, excepting the dam and the first three wheels. He substituted iron pipe for the wooden water pipe, designed hydrants and stops, and in many ways perfected the system for the distribution of water in Philadephia. He remained at the head of the Water Department until his death, which occurred April 13, 1847.

Mr. FREDERIC GRAFF, Jr., after completing his education, became a civil engineer, and was an assistant to his father in the Water Department. In 1847, on the death of the elder Mr. GRAFF, the son was elected to succeed him as Superintendent and Chief Engineer, and he remained in that office until 1853, when, from political cause, he resigned his position. In 1856 he was again elected Chief Engineer, and held that office until 1873, when he permanently retired from all public office. In his later life Mr. GRAFF devoted his time and his energies solely to the profit of various organizations and institutions with which he was connected. He was one of the founders of the Philadelphia Zoological Society, and its president from 1882 until his death; from 1867 to 1873 he was a member of the Fairmount Park Association; Vice-President of the Franklin Institute; Vice-President of the Pennsylvania Museum and School of Industrial Art, and was honorably connected with the Pennsylvania Institution for the Deaf and Dumb, the Academy of Natural Sciences, the American Philosophical Society, the Pennsylvania Historical Society, etc.

During 1880-81 Mr. GRAFF was President of the Engineers' Club of Philadelpia, and from Jan. 21, 1885, to Jan. 20, 1886, he was President of the American Society of Civil Engineers, his membership in the latter society dating from May 7, 1873. His last professional service was as one of the board of expert engineers appointed by the United States Government to examine and report upon the condition of the Washington Aqueduct Tunnel and possible plans for its utilization. In this work he was associated with Mr. HENRY FLAD, Past President of the American Society of Civil Engineers, and Mr. JOSEPH M. WILSON, M. Am. Soc. C. E.

PUBLICATIONS RECEIVED.

—*Preliminary Geological Map of the State of Kentucky.* By J. B. HOEING, C. E. Under JOHN R. PROCTER, Director of the Kentucky Geological Survey. 1890.—A very handsome map in colors, on a scale of 10 miles to an inch.

—*Classification and Rates for Car-loads and less than Car-loads.* Decision by Interstate Commerce Commission. Pamph., pp. 43.

An interesting opinion, filled with facts as to rates and traffic, holding that the less than car-load rates are far too high in proportion on the Eastern Trunk lines, and ordering their reduction.

—*Report of the Railroad Commissioners of Kentucky* for the year 1889. 8vo. pp. 419, large colored map.

The report shows an increase of 232 miles over 1888, or 2,832 miles in all. Twenty-nine miles of short coal and lumber roads, too unimportant to be given names, are included in this increase, most improperly, we think. A railroad in the proper sense is not mere track and rolling stock, but a common carrier doing a general freight and passenger business. The report takes high ground in favor of Congressional action on uniform safety appliances.

—*Simple Elements of Navigation.* By Lucien Young, U. S. Navy. New York: John Wiley & Sons, 1890. 12mo., 226 pp.—An excellent publication in pocket-book form, treating of the simpler elements of navigation, but with tables added that make it of practical use in navigating to any part of the globe. The log, log-glass and compass are illustrated and fully described, as is the use of the chart in piloting or coasting, and the determination of position by dead-reckoning, observation, etc. The book is, in fact, a compendium of the elements of navigation, plainly expressed, without the use of other than the simplest mathematics, and excellently adapted to the needs of the naval apprentice, merchantman, or yatch owner.

—*The Maritime Ship Canal of Nicaragua.* Prospectus of 1890. 8vo., pamph., pp. 17, with maps, profiles and tables.

The most salient feature of this pamphlet, beside the interesting testimony, which it bears to the considerable progress, already made, is the details it gives as to the increase in the commerce of the world and the probable traffic of the canal, which we fully believe is rather under than over estimated at 7,000,000. As noted in another column, the company has let the contract for the first 12 miles of railway across the swamps to Mr. CHAS. P. TREAT, this being a necessary preliminary to starting work on a large scale, and in all respects the omens for the future are most propitious.

—*The Traffic Capacity of the New York and Brooklyn Bridge Railway.* By G. Leverich, C. E. Brooklyn, 1889 Pamph., pp. 40, 32 plates.

This pamphlet gives many interesting facts as to the past and present of the bridge traffic, never before published in so complete a way; but is mainly devoted to a representation of a dozen or so of different plans for handling the bridge traffic, all of which were presented in their substance before the late Board of Experts, and all of which were rejected by that Board in language about as severely condemnatory as could well be framed, a fact which is judiciously kept in the background in the pamphlet by simply stating (p. 34) that the "Board of Experts reported Feb. 23, 1888," without stating that they reported in condemnation of every plan advocated in the pamphlet. The nature of the plans thus condemned can be in a measure judged from the fact that it is gravely proposed to run 4 car trains on 25 seconds headway, the train itself being in time 13.6 seconds long, so that the clear interval between trains would be only 11.4 seconds, or about three car lengths; and this on triple-gauntleted tracks! The appearance of such a pamphlet at this time from an Assistant Engineer of the bridge would seem to indicate that the whole question of what plan to adopt is as much in the air as ever.

—*Kentucky Geological Survey.*—JNO. R. PROCTER, Director.—Reports on Eastern Coal Field. 1884.—Reports on Western Coal Field. 1884.—Chemical Report on Coals, Soils, Clays, Petroleums, Mineral Waters, etc., of Kentucky; by ROBERT PETERS, M. D.; 1888.—Preliminary Reports on the Southeastern Coal Field of Kentucky. By A. R. CRANDALL and J. M. HODGE. 1887.—Reports on Progress of the Survey, from January, 1888, to January, 1890. By JOHN R. PROCTER. 1890.—The first two volumes are reprints, with a new arrangement, of older reports, and bring together in compact form the work under Mr. N. S. SHALER as Director. Mr. JOHN R. PROCTER has been State Geologist since 1880, and speaks of the progress of the survey as follows: The topographic work has been for a number of years in the charge of Mr. J. B. HOEING. This department is engaged in surveying the various counties and publishing maps on a scale of 2 miles to an inch; in compiling and publishing a State map on a scale of 10 miles to an inch, and in making a State map on a scale of 1:300,000 or about five miles to an inch. In the geological section Dr. D. D. OWEN has been the chief assistant. In addition to extensive reports on the coal fields already published and in preparation, enough has been learned to establish the fact that there are reliable natural gas reservoirs in the State, and an early report on natural gas and petroleum is promised. Prof. EDWARD ORTON, State Geologist of Ohio has been investigating this latter subject for 1888, 1889. The chemical work is in charge of Dr. ROBERT PETER. Mr. PROCTER says that the annual total appropriation for this survey in all its departments has been less than $10,000; and he believes the work performed with this amount is sufficient to convince any one that due economy has been observed in its expenditure.

TRADE PUBLICATIONS.

—*A. Wyckoff & Son Patent Steam Pipe Casing.* Elmira, N. Y.

A brief but interesting folder, giving what looks like good evidence that the casing is highly effective, as it certainly is ingenious and cheap.

—*Catalogues and Price Lists* of Brown & Sharpe Mfg. Co. and Darling, Brown & Sharpe, Providence, R. I., January, 1890.

Illustrations and particulars of machine tools, gears, rules, gauges, etc. Size 5¼x3½ ins.; 205 pp.

—*Locomotives.* Hunslet Engine Co., Leeds, England.—Folding card of small photographs of a number of engines of different classes, for English and foreign lines. Several of these engines have outside cylinders and 4-wheel trucks. Tank engines are in the majority, that being a type of engine much used by English engineers both at home and abroad.

—*Urie Dredge Mfg. Co.*, Kansas City, Mo.

Illustrated pamphlet with descriptions of dredges of different kinds. Size 9¼x6 ins.; 12 pp. The company manufactures a new improved dredge, said to be simple in construction, easily and cheaply operated. It is on the elevator plan, with buckets on a roller chain traveling on a ladder frame.

SOCIETY PROCEEDINGS.

Engineers' Club of Philadelphia.—Record of regular meeting, March 15, 1890; President H. W. Spangler in the chair; 19 members and one visitor present. Owing to the unavoidable absence of the Secretary, the paper expected to have been read was not presented. Mr T. Carpenter Smith presented an account of the Method of Towing Coal Barges on Western Rivers. Mr. Wilfred Lewis presented an account of a recent visit to the works of the Simonds Rolling Machine Co., at Fitchburg, Mass.

HOWARD MURPHY,
Secretary and Treasurer.

The Polytechnic Society of Utah is probably the latest born of American technical societies. This society was organized last month in Salt Lake City, and is composed of civil, electrical and mining engineers, with assayers, chemists and surveyors associated with it. The by-laws state that the objects of the society are the professional improvement of its members and the encouragement of social intercourse among men of practical science, the advancement of scientific professions and the establishment of a central point of union and reference for its members. The requirements for membership are somewhat similar—though broader in the professions represented—to those of the Society of Civil Engineers. The following officers are elected for the first year: Colonel C. L. Stevenson, President; General Daggett, Vice-President; M. S. Hanauer, Secretary; W. E. Jacobs, Treasurer. C. F. Annet, M. Mack, M. D. Kerr, Directors.

Engineers' Club of Kansas City.—At the meeting, on March 3, Mr. G. W. Pearsons read a paper on "Photography applied to Surveying."

"The focal length of camera best adapted to this work is from 12 to 15 ins. The image formed on the sensitive plate represents a series of right lines passing through the centre of the lens from the landscape to it. If, therefore, the plate is in correct position it will give a mathematically correct copy, capable of direct measurement, and to a much greater degree of accuracy than would be at first imagined. For purposes of precision proper regard must be paid to the positions of the plate and camera. The former must be truly vertical, and, for a proper definition of the horizon, its edges should be horizontal. The angle covered by the plate must be known, and sufficient lap should be allowed to join consecutive prints.

"The centres of plates should be correctly located, vertically and horizontally, as they must be measured by a scale of tangents from the vertical centre and horizon. The focal distance should remain fixed.

"After taking a series of views from the first station, proceed to the next point and take another set in the same manner, intersecting the first. The points of observation being known, these intersections determine any desired point in the field of view. The third station bears on the first two, the fourth on the second and third, etc., forming a continuous triangulation on which most points may be defined as to height by the tangent of its distance from the point of observation. The plates therefore give vertical as well as horizontal definitions of the field and with a degree of accuracy which will surprise the engineer." KENNETH ALLEN, Secretary.

American Society of Civil Engineers.—The regular monthly meeting was held April 2, President Wm. P. Shinn, in the chair. By the new plan of canvassing the ballots, those for membership will be canvassed at the meetings by the employés, and other ballots will be canvassed by the secretary at some other time. This is a decided improvement upon the old plan of appointing some of the members present at the meeting to canvass the ballots; under this plan these members have been prevented from hearing the papers read, and this has been much objected to by the persons so selected. The annual convention will be held at Cresson, Pa., toward the end of June.

The secretary announced the death of Mr. Frederic Graff, Past President of the Society.

The canvass of the ballots on resolutions resulted as follows:

(1) To discharge the committee appointed to prepare designs for a series of standard rail sections, from 40 lbs. upward. Affirmative, 92; negative, 125.

(2) To appoint a committee to consider units of measurement. Affirmative, 96; negative, 85.

(3) To appoint a committee to suggest a uniform nomenclature for structures used in sewerage. Affirmative, 90; negative, 99.

The President called attention to the irregular and incomplete manner in which ballots are frequently filled in. Engineers, he said, should be precise and careful in all business matters, and he did not think it creditable to the membership that ballots should be so often received unsigned, incomplete or otherwise informal. The President's remarks were very much to the point, and are to be printed and sent out to the members.

A paper on "Tunnel Surveying on Division No. 6, Croton Aqueduct," was read by F. W. Watkins, M. Am. Soc C. E. He commenced by calling attention to the lack of literature on the subjects of the preliminary work and surveying of tunnels. On the Weehawken tunnel of the New York, Ontario & Western Ry., the shafts were 8 x 16 ft., the greater length being across the axis of the tunnel; this gave a working base of only 7 ft. 10 ins. On Division No. 6 of the aqueduct tunnel, the shafts were 17 ft. 6 ins. x 8 ft., and 11 ft. x 8 ft., placed at one side of the centre line and with the greater length parallel with the axis of the tunnel. The methods of transferring the line down the shaft and extending it into the headings were described in detail. The plummet weights were of cast iron, 25 lbs. each, and were immersed in a bucket of water or linseed oil. The numerous difficulties encountered in this underground work were also described. To facilitate the sighting of the wires at the bottom of the shaft, Mr. Watkins designed an "illuminated slit" apparatus, by which plates can be adjusted to leave a narrow slit in line with the wire, and by placing a light behind this slit, the wire can easily be sighted. In the roof of the tunnel wooden plugs were driven; iron spikes driven into these had brass plates attached to the head, with an adjustable sliding vernier plate, by which the exact centre line could be marked according to the line given by the transit. For taking the cross section of the tunnel, different forms of apparatus were used. Mr. Craven's "sunflower" apparatus consisted of a circular protractor on a tripod stand; this had a hardwood arm to which was attached a measuring rod 14 ft. long; the tripod being set up on the centre line, measurements were taken to the sides of the tunnel, and the arm showed the angle at which these measurements were taken. A platting machine working on the same principle was used in the office.

In the discussion on this paper Mr. Wegmann referred to the accuracy of modern tunnel surveying, and several members referred to cases in which great accuracy of alignment had been obtained. In the Hoosac tunnel, the centre shaft was 1,028 ft. deep and gave a base of 22 ft.; from the shaft headings were run half a mile each way to meet the headings driven from the portals. The errors were only 5-16 and 9-16 in. in the lines. In the Gotthard tunnel, 9.6 miles long, driven from the two portals, the meeting of the lines was only 1 ft. out. Mr. Fteley referred to the case of the Dorchester Bay tunnel, where the centre line was transferred to the bottom of the shaft by sighting with a transit placed at the top; the base at the bottom was 10 ft. long. (This work was described in ENGINEERING NEWS, Aug. 16 1884. The construction was described in a paper on "Shaft Sinking under Difficulties at the Dorchester Bay Tunnel," Trans. Am. Soc. C. E., October, 1881.)

The following candidates were declared elected:

MEMBERS.

James Henry Covode, Chili, So. Am.

George S. Davison, Chf. Eng. and Supt., P. C. & Y. Ry., Pittsburg, Pa.

Peter C. Hains, Lieut. Col. U. S. Engineer Corps, Washington, D. C.

Alexander Wm. Jardine, Eng. in Chf. of Rivers and Harbors, Queensland, Australia.

Thomas Henry McCann, C. E., Hoboken, N. J.

Gaylord Thompson, Asst. Eng., Section No. 8, New Croton Aqueduct, Yonkers, N. Y.

ASSOCIATE.

Lewis R. Pomeroy, Carnegie, Phipps & Co. (of Pittsburg), New York.

JUNIORS.

Robert W. Creuzbaur, Brooklyn, N. Y.
Charles W. McMeekin, Des Moines, Ia.

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AND

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D. McN. STAUFFER A. M. WELLINGTON

EDITORS.

CHAS. W. BAKER E. E. R. TRATMAN M. N. BAKER

ASSOCIATE EDITORS.

GEO. H. FROST.....BUSINESS MANAGER

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Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

COMING TECHNICAL MEETINGS.

Engineers' Club of Philadelphia, Pa.—Next meeting, April 5. Secy., Howard Murphy, 1122 Girard St.

Civil Engineers' Society, St. Paul, Minn.—Next meeting, April 7. Secy., Geo. L. Wilson, City Hall.

Civil Engineers' Club, Cleveland, O.—Next meeting, April 8. Secy., C. O. Palmer, 22 Cedar Ave.

Civil Engineers' Association of Kansas, Wichita, Kan.—Next meeting, April 9. Secy., J. C. Herring, Wichita.

New England Railway Club, Boston Mass.—Annual meeting, April 9. "Locomotive Boilers." Secy., F. M. Curtis, Old Colony R. R. Rooms in the United States Hotel.

Engineering Association of the Southwest, Nashville, Tenn.—Next meeting, April 10. Secy., Olin H. Landreth, Vanderbilt University.

Engineers' Club of Kansas City, Mo.—Next meeting, April 14. "Bridge Substructure in the Kansas River." E. I. Farnsworth. "Drawbridges as Closed by Water Power," and "River Motors in Europe," S. N. Stewart. Secy., Kenneth Allen, 200 Baird Building.

Engineers' Club of St. Louis, Mo.—Next meeting, April 16. "Railway Inclines," I. A. Smith; "The Reproduction of Drawings," D. C. Humphreys. Secy., W. H. Bryan, 309 So. 7th St.

American Society of Civil Engineers, New York.—Next meeting, April 16. Secy., John Bogart, 127 E. 23d St.

Civil Engineering Society (Mass. Inst. of Technology), Boston, Mass.—Next meeting, April 17. Secy., Clement March.

Western Railway Club, Chicago, Ill.—Next meeting, April 15. Rooms in the Phœnix Building. Secy., W. D. Crosman.

Engineers' Society of Western Pennsylvania.—Next meeting, April 15. Secy., S. M. Wickersham, Pittsburg, Pa.

Boston Society of Civil Engineers.—Next meeting, April 16. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting, April 17. Rooms, at 113 Liberty St.

Western Society of Engineers, Chicago, Ill.—Next meeting, May 1. Secy., J. W. Weston, 230 La Salle St.

American Water-Works Association.—Annual meeting at Chicago, Ill., May 20. Secy., J. M. Diven, Elmira, N. Y.

Master Car-Builders' Association.—Annual convention at Hygeia Hotel, Fortress Monroe, Va., June 10. Sec., J. W. Cloud, Buffalo, N. Y.

American Railway Master Mechanics' Association.—Annual convention in June. Sec., Angus Sinclair, 140 Nassau St., New York.

WHILE best known in Philadelphia, as one of its most useful, public-spirited and honored citizens, Mr. FREDERIC GRAFF, whose death we regret to announce this week, was a prominent member of the American Society of Civil Engineers, and one of the most conscientious and efficient presidents of that society yet elected. Mr. GRAFF made duty and service to his fellow man his watchword through life; never allowing private affairs or personal inconvenience in any way to interfere with his view of the full performance of this duty. Although a resident of Philadelphia, he rarely omitted attendance at the official meetings of the American Society of Civil Engineers, in New York, during his term as president of that body; and with this, as with the other numerous organizations of a scientific or philanthropic character with which he was connected, his services and his advice were always at the command of his fellow members. Personally he was a man loved, respected and honored by all with whom he came in contact, and his unexpected death will be felt as a personal loss by his multitude of friends.

THE great city of Chicago last week refused to increase the salary of its City Engineer from $3,500 to $5,000, and cut the salary of its chief Assistant Engineer from $2,400 to $2,000. But at the same meeting of councils, Mr. MCGANN, the Superintendent of the Street Department, had his salary raised from $3,500 to $4,000, and his assistant had his salary increased from $1,800 to $2,000. A motion to raise the salary of the Fire Marshal from $5,000 to $6,000, and one to raise the salary of the First Assistant Fire Marshal from $3,000 to $4,000, were lost. While Chicago gets much more than its money's worth in its present City Engineer, it is a very small piece of business in the city authorities to rank its engineers, in compensation, so much below other and really less important officials. The training and experience required to properly fill the position of City Engineer to a great corporation are very cheap at $5,000 per annum; and if the present incumbent of that office gave them $3,500 worth of engineering, and no more, the city would soon find that it was economical to pay the higher price.

THE full text of the finding of the New York State Railroad Commission on the Hamburg disaster of March 6, reprinted in its essential technical features in another column, explains what has heretofore appeared inexplicable: how the air-brake hose happened to pull off instead of the couplings parting in the usual manner. It appears that the steam coupling was in such position that its drip fell on the brake coupling, with the natural result (it being freezing weather) that the latter was frozen solid. We recall no previous case of this kind, and it reveals a danger easily guarded against, which yet may easily be overlooked. It is to be hoped that the warning will be taken in time.

THE Board also enters more fully than we knew of last week into the merits and demerits of the Cowell coupler. They condemn it unsparingly, and, perhaps, if the whole question were now an open one, as it was ten or twenty years ago, somewhat too severely, since the grave defects of detail which it points out might possibly be corrected. But the true reason why the condemnation which they express is most timely and wise, is that further experimenting, with a view to pushing still other couplers on the market, is against the public interest, tending to introduce confusion worse confounded, when the tendency otherwise is all toward uniformity; and this without the least prospect of a real mechanical advance therefrom. We sympathize strongly with all the hundreds of persons who have devoted much time and money and great and successful ingenuity to the creation of new types of couplers of mechanical promise. There was a time when their labors did good; but that time is now past. They now do only harm, especially when their only motive and strength lies in the effort to preserve the power to intercouple with an old coupler which is felt to need improvement, but which those who have it in use are loth to throw away.

THE following choice excerpt (from the Sydney *Morning Herald*) as to engineering practice at the Antipodes is forwarded to us by an Australian correspondent. We, of course, know nothing of the other side of the question, if there is any, and hence cannot give it; but the source of the statements would seem to guarantee their substantial correctness. The scrap reaches us with almost every other word underlined, but as such numerous italics defeat their own purpose, we print it in its original form without any italics:

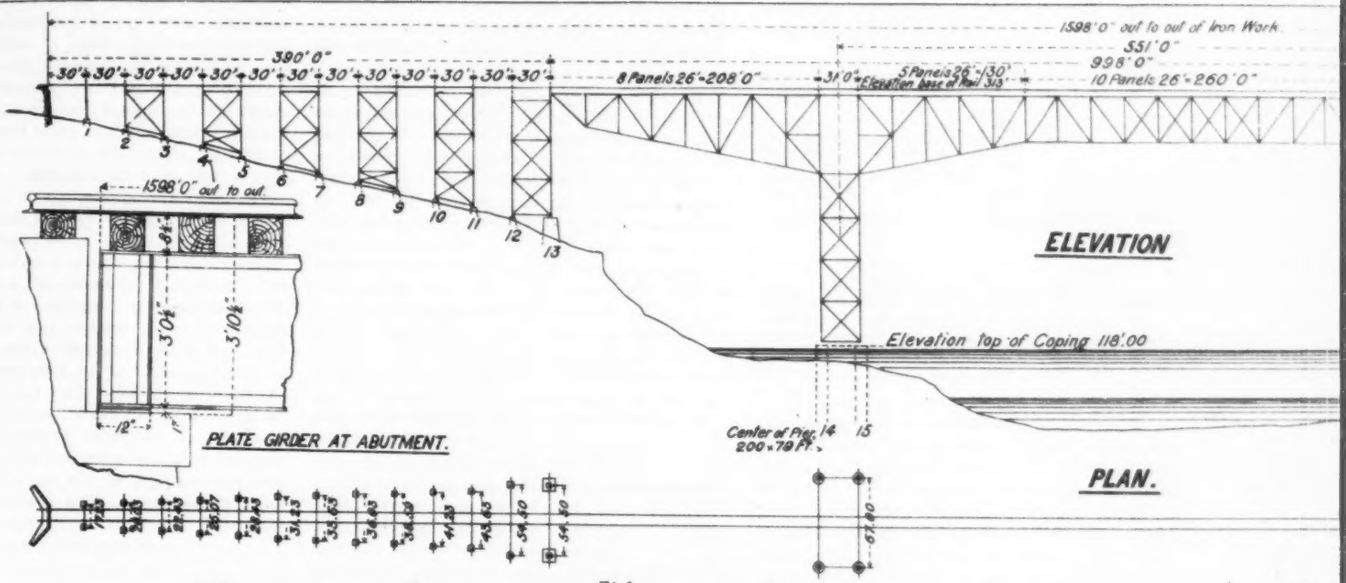
> The subject of initial surveys came up at the meeting of the Parliamentary Standing Committee on Public Works yesterday during the examination of Mr. HENRY DEANE, Acting Engineer-in-Chief. In the course of inquiries made by this committee into the various railway proposals, it has become evident that the surveys on which the estimates of cost are based were in many cases of a very casual character. The custom of the Public Works Department was to send an officer to look at the country through which the proposed line was to pass, following as nearly as possible a direct line between the starting and terminal points, and without any regard to back country, capabilities of traffic, or even the easiest route. Revised surveys have in many cases been made either shortly before the proposal has gone to the committee or during its sittings, and the result has usually been to find a line with fewer engineering difficulties, lighter gradients, and easier curves, and a consequent reduction in cost per mile. The Mudgee-Gulgong Railway proposal is a case in point. The estimated cost per mile was, on the initial survey, £9,688 per mile; a revised survey keeps the line of the same length (18 miles), reduces the gradients from 1 in 40 to 1 in 80, saves at least £5,000 on a bridge, avoids several heavy earthworks, and the work is now estimated to cost £5,800 per mile. In view of the closeness of the committee's inquiries, Mr. DEANE told them that he had found it necessary to remodel the system on which initial surveys were conducted, so that at the outset a fairly accurate knowledge may be obtained by the Department of where the permanent survey would go, and consequently a true approximation to the cost of the work could be given.

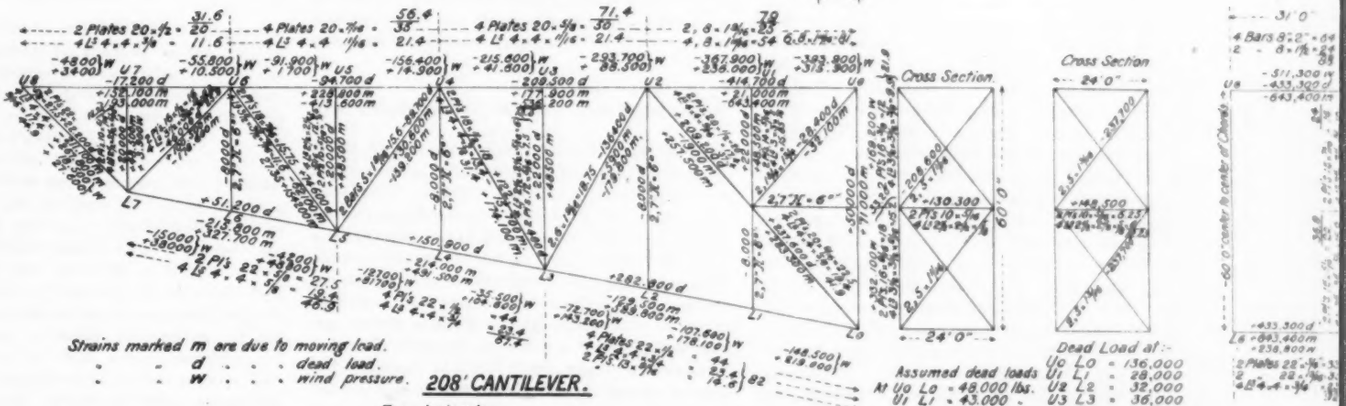
If Mr. DEANE correctly describes the way in which the 2,000 odd miles of railway in New South Wales have been laid out, it is certainly a pretty loose way. The Engineer-in-Chief for the colony is Mr. JOHN WHITTON, a brother-in-law of Sir JOHN FOWLER, we believe, who holds the position of Consulting Engineer for the same colony. The English system in these matters makes some pleasantly liberal incomes for a few engineers, but on the whole, the American system, if less profitable to some engineers, is probably more so to the public and the railways.

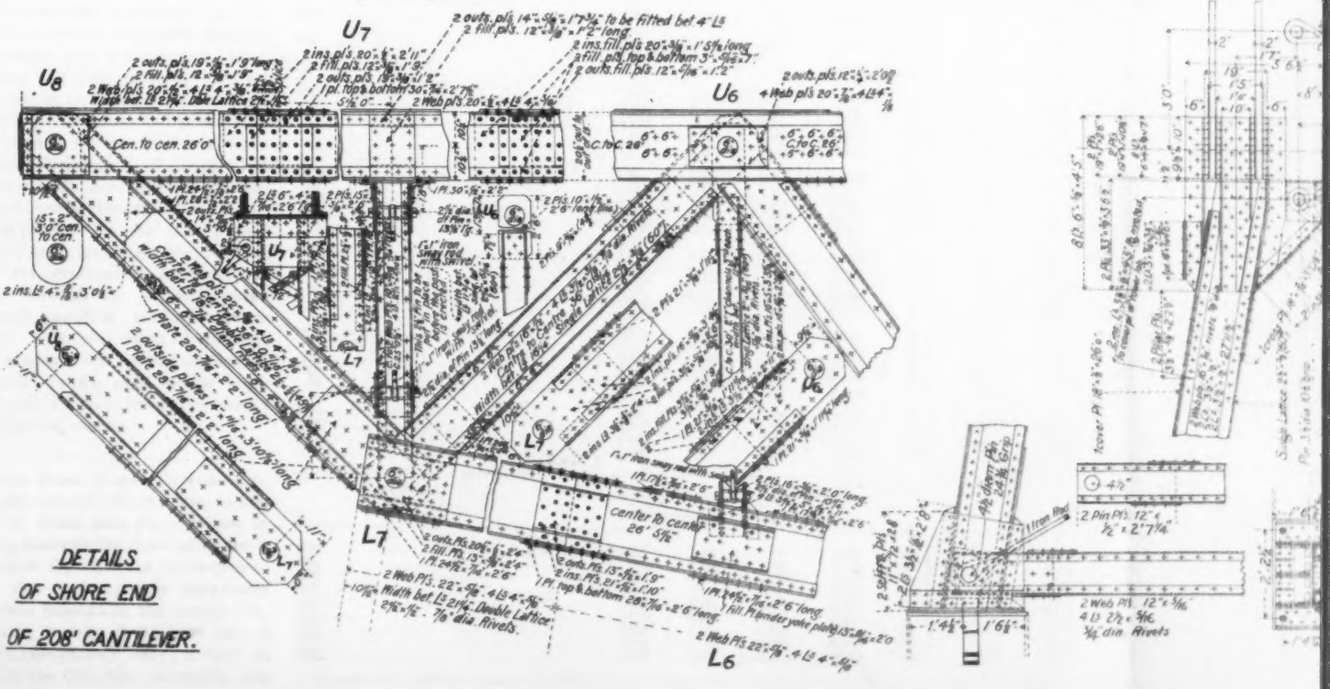
A BOSTON correspondent, Mr. ALBERT H. HOWLAND, writes us in regard to deflection tests of bridges, as follows:

> In your issue of March 8 I referred to the unreliability of the deflection test as a means of ascertaining the safety of bridges, and in that of March 15 Mr. THEODORE COOPER expressed the same view quite emphatically.
>
> The Illinois Railroad Commissioners apparently thought that the way to determine the safety of the five remaining spans of the Peoria & Pekin Union bridge, after one span had fallen, was to take the deflection. In a similar case some years ago I incurred some obloquy for stating that such tests were useless or even worse than useless.
>
> Now, it seems to me that you would confer a benefit upon the public if you would emphasize editorially the danger of trusting to such tests. You might influence some parties that would not be reached through your correspondence columns.

We fear our correspondent overrates our influence, and moreover, we are not sure that we fully agree with him. As to the danger of "trusting" to deflection tests we are wholly with him; and also as to the "unreliability" of the deflection test, to the extent that stiffness in itself is no real evidence of strength, and still less the mere fact of


1598'0" out to out of Iron Work
551'0"
998'0"
390'0"
30'+30'+30'+30'+30'+30'+30'+30'+30'+30'+30'+30'+30'+30'+30'
8 Panels 26'=208'0"
31'0"
5 Panels 26'=130'
10 Panels 26'=260'0"
Elevation base of Rail 3½'
1598'0" out to out.
3'0½"
3'10½"
12"
ELEVATION
Elevation top of Coping 118'.00
PLATE GIRDER AT ABUTMENT.
Center of Pins 200'=79 Ft.
PLAN.

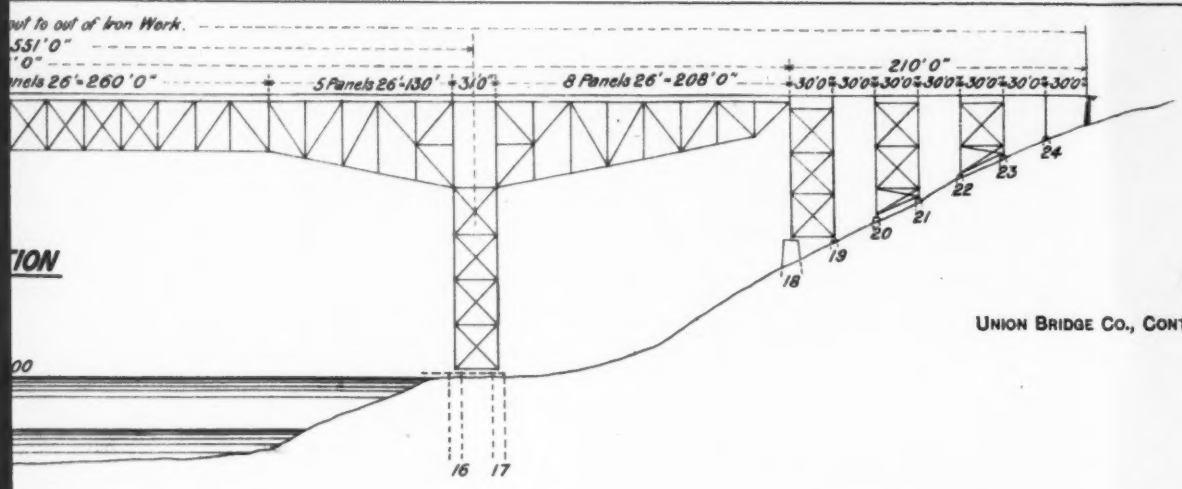

Cross Section.
Cross Section
24'0"
60'0"
24'0"
Strains marked m are due to moving load.
" " d " " dead load.
" " w " " wind pressure.
208' CANTILEVER.
Top Laterals.
Bottom Laterals.
Assumed dead loads
At U0 L0 = 48.000 lbs.
U1 L1 = 43.000 "
U2 L2 = 40.000 "
U3 L3 = 37.000 "
U4 L4 = 34.000 "
U5 L5 = 31.000 "
U6 L6 = 28.000 "
U7 L7 = 25.000 "
U8 L8 = 16.000 "
Dead Load at :-
U0 L0 = 136,000
U1 L1 = 28,000
U2 L2 = 32,000
U3 L3 = 36,000
U4 L4 = 40,000
U5 L5 = 48,000
Floor-beams at U5 and U6 Shear = 61,000
Stringers for 31 ft. Panel c/c Shear = 43,000

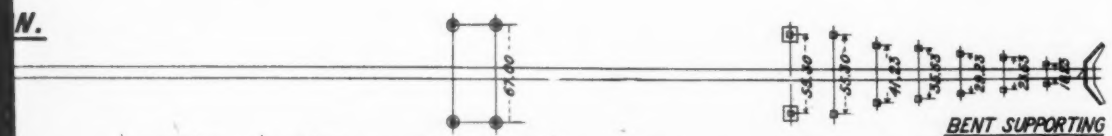

U7
U8
U6
L7
L6
Cen. to cen. 26'0"
C. to C. 26'
center to center 26'-5⅞"
2 Web Pl's 22"-⅞"-4 L3 4"-⅞"
2 Pin Pl's 12"-1½"-2'7¼"
DETAILS
OF SHORE END
OF 208' CANTILEVER.

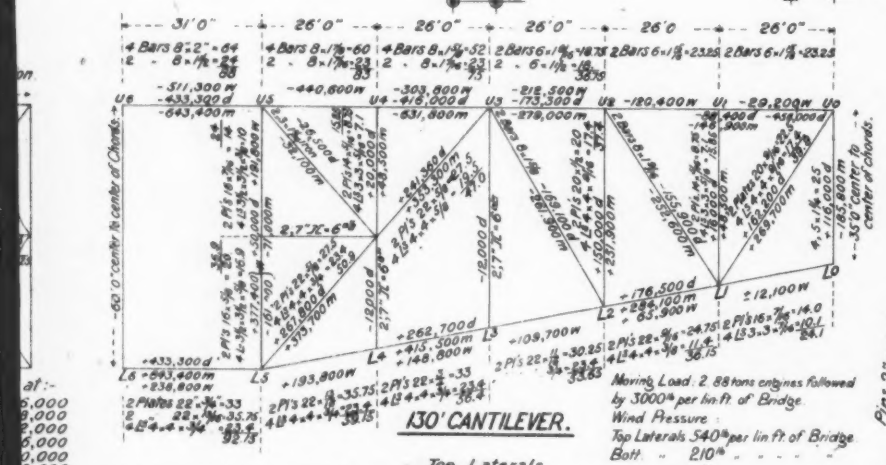
BRIDGE
OVER
THE KENTUCKY RIVER,
LOUISVILLE SOUTHERN RAILROAD.

UNION BRIDGE CO., CONTRACTORS.

J. W. MACLEOD, CHIEF ENGINEER.

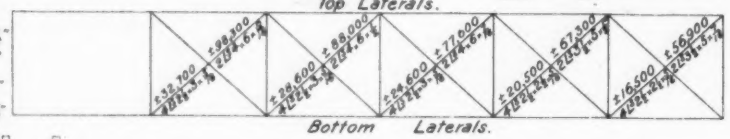




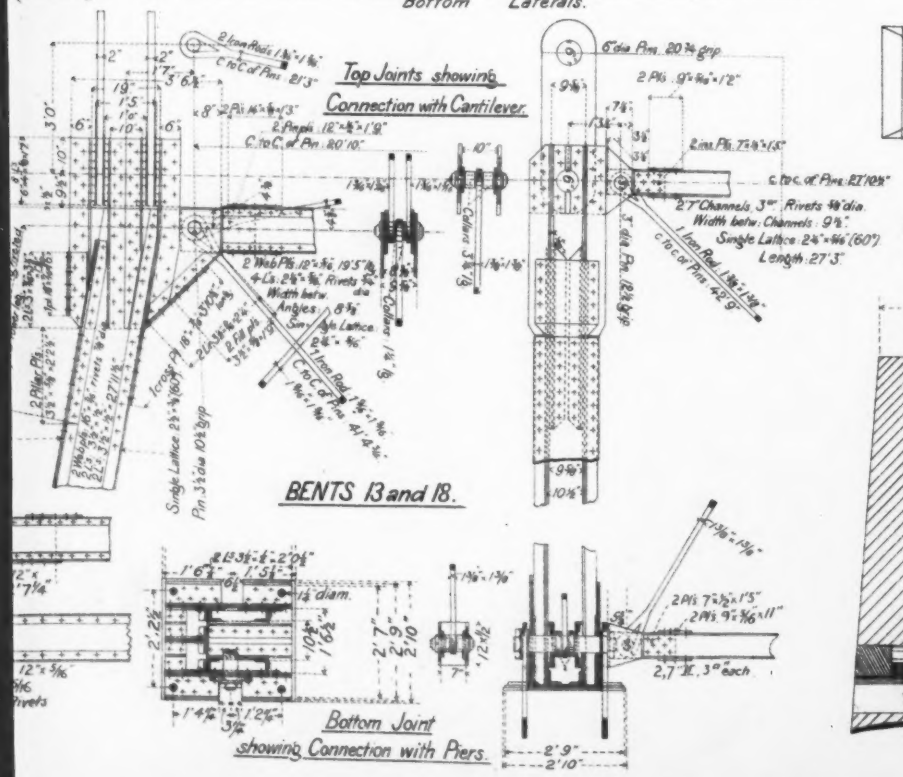


130' CANTILEVER.

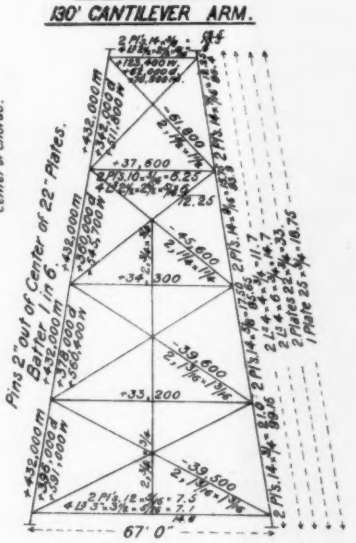
Top Laterals.

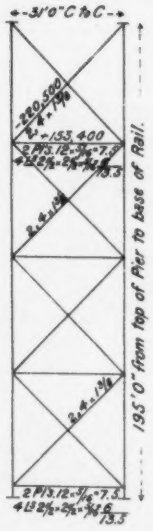


Bottom Laterals.

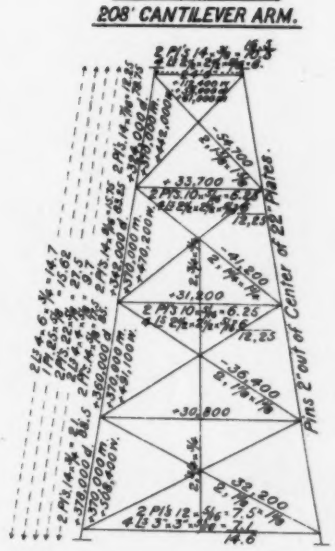

Top Joints showing Connection with Cantilever.
6" dia Pin 20⅞ grip
2 Pls 9"×⅝"×1'2"
2 Web Pls 19"×⅝"×19'5"
4 Ls 2½"×2½"×⅜" Rivets ⅞" dia
Width betw. Angles 8⅛"
Single Lattice 24"×⅜"@60°
2 Pls 12"×⅝"×1'9"
C to C of Pins 20'10"
C to C of Pins 27'10½"
2-7" Channels 3" Rivets ⅞" dia.
Width betw. Channels 9½"
Single Lattice 24"×⅜"@60°
Length 27'3"
1 Iron Rod 1⅜" dia
C to C of Pins 42'9"
C to C of Pins 41'4½"
Pin 3½ dia 10⅞" grip
BENTS 13 and 18.
2 L 3½"×3½"×2'0½"
1½" diam.
Bottom Joint showing Connection with Piers.
2 Pls 7½"×1"×5'
2 Pls 9"×⅝"×11"
2,7" IE, 3" each

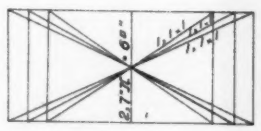
BENT SUPPORTING 130' CANTILEVER ARM.





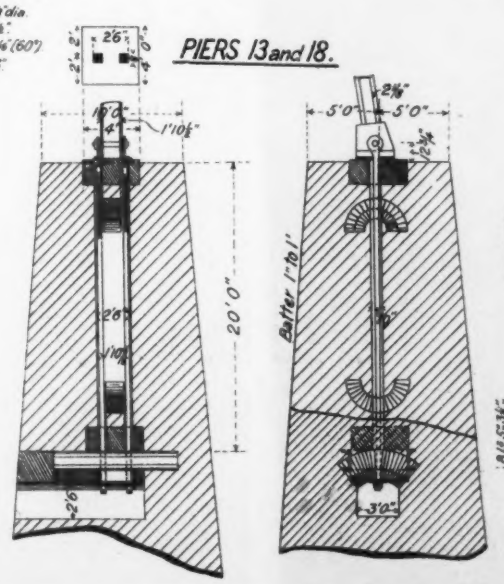
BENT SUPPORTING 208' CANTILEVER ARM.

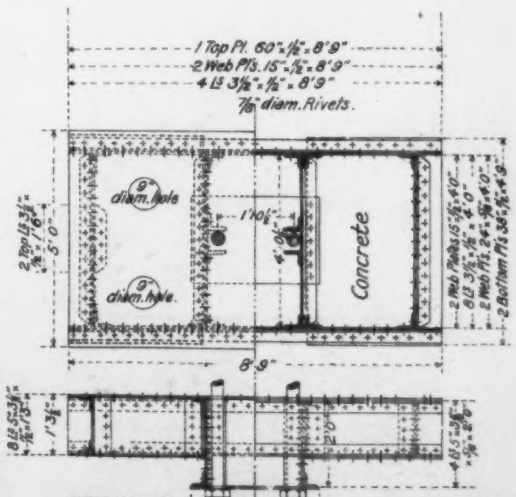




Bent No	Elevation of Masonry Top	Height Masonry to Base of Rail.
1	286.0	27.0
2	279.0	34.0
3	273.0	40.0
4	266.4	46.6
5	258.0	55.0
6	251.0	62.0
7	245.0	68.0
8	239.0	74.0
9	232.6	80.4
10	226.0	87.0
11	220.0	93.0
12	213.0	100.0
13	213.0	100.0
14	118.0	195.0
15	"	"
16	"	"
17	210.7	102.3
18	"	"
19	226.0	87.0
20	240.0	73.0
21	256.0	57.0
22	270.0	43.0
23	283.5	29.5
24		

PIERS 13 and 18.





DETAILS OF ANCHOR.

CHAS. HART & SONS, LITH., 26 VESEY ST., N.Y.

recovery without set, as Mr. COOPER very forcibly and correctly pointed out in his letter. But that excessive deflection is presumptive evidence that something is wrong, especially in connection with much lateral vibration, and hence that deflection tests, properly studied and interpreted, are an excellent, simple, and ready mode of getting quickly some idea of the condition of a bridge, we hold to be equally clear. Moreover, we hold that a considerable degree of stiffness is a necessary condition for a good railway bridge, for the reason that when the deflection is considerable dynamic effects are introduced which are highly destructive, even if not immediately dangerous. The deflections must be considered in connection with the strain sheets and sections to interpret them properly, but a railway bridge of large deflection ought, in our judgment, to be always looked on with suspicion, and will generally prove to be more or less inferior. Some are exceedingly inferior, and their liberal deflections are the sign and token of it. But it is unquestionably true that whether this is so or not in any particular case cannot be determined even approximately from the deflections alone, and that small deflections may occur in a very faulty structure.

As nearly as can be judged from the imperfect reports which have as yet reached us, the *City of Paris* had the narrowest escape which any ocean steamer has yet had from a frightful disaster, though it is not yet easy to understand the precise nature of the trouble. The reports at first telegraphed were that the "low-pressure cylinder" had exploded, which seems absurd, that cylinder having little or no pressure in it, but working chiefly against a vacuum. The high-pressure or intermediate cylinder might have exploded, but they would have been little likely to blow a hole through the bottom of the ship, and it would be a most unusual occurrence that they should explode at all. The most probable explanation of the accident seems to be that some connecting rod broke so as to rupture some injection pipe, perhaps causing some further secondary breakages, which ruptured the bulkhead, and so disabled by flooding the second engine. The notable fact is that in this, the first disaster of consequence to a large double-screw passenger steamer, the very thing happened which has been assumed to be all but impossible, viz., simultaneous disabling of both engines. There can be but little doubt that, had the accident happened in midocean, so that the ship had been unreported longer than was necessary for a single screw to bring her into port, the greatest alarm would have arisen, and the ship been practically given up for lost. The ship had practically been overdue long enough for this as it was, since one screw gives about 70 per cent. of the speed of both. The accident reveals some defect in precaution, which will doubtless be remedied, for it certainly should not be possible for the main pumps to be disabled by any such breakage, nor for one of the engines to be permanently knocked out merely by flooding, through any probable puncture of the bulkhead partition, while otherwise still in good order. The real facts of the case, however, are still obscure, and do not appear to have been accurately known, even to the engineers, who had to run for their lives after one of them had bravely shut off steam.

THE PHILADELPHIA *Press*, in severely condemning the captain of the *Adriatic* for refusing to tow the disabled *City of Paris* into port, praises in terms of contrasting warmth the "merciful heroism" of the captain of the *Ohio* for his answer to the call for help. Our contemporary apparently forgets that the *Ohio* belongs to the Inman Co., and that in rescuing a ship of its own line it simply performed a compulsory duty, a duty in which the captain of the *Ohio* had no option, and for failing to perform which he would have subjected himself to severe discipline. As we read it, the *Adriatic* was willing to transfer all the passengers of the *City of Paris* to a port of safety, but simply refused, at the cost of serious delay and inconvenience to herself, to attempt to save the property of a rival line in which her owners had no interest. The captain of the *Adriatic* had his duties to perform to his passengers and to his owners; and his company could have been held responsible for a delay that might have occasioned serious loss in various ways to those who were aboard, or were awaiting property consigned to them in this ship. It is the undoubted duty of every ship-master and ship-owner to save life, no matter what that rescue may cost in time or money. But the saving of property, rewarded as it would be by salvage fees, is quite another thing; and we believe that the course taken by the captain of the *Adriatic*, as far as now known, was a sound one, and dictated by a proper sense of duty to his passengers, his trusts, and his owners. The captain of the *Ohio*, on the other hand, commanded a ship owned by the same line to which the *City of Paris* belonged; and he also performed his duty, and only that, when he took measures to save the property of a common owner, and held his owners responsible for any loss to others that might have occurred through his actions.

The Course of the World's Iron Production.

The New York *Tribune* published on March 28 an interesting little table, which we presume to have been correctly computed, showing the extremely rapid rate at which both the production and consumption of pig iron has increased in this country during the last 40 years. It is difficult to realize that the consumption has grown so fast that each man, woman and child is now "consuming" nearly as much of pig iron as he does of bread, especially when we remember that pig iron does not disappear, as bread does, when "consumed," but remains as a continuing stock, barring a small wastage. Here, however, are the figures for it in pounds per inhabitant—we do not doubt substantially accurate:

	1850.	1869.	1879.	1889.
Consumption, domestic pig	54.61	102.43	126.06	261.40
Consumption, imported pig and scrap	5.88	19.63	51.50	6.20
Consumption, tot'l raw iron	60.49	122.06	177.65	267.60
Consumption, imported rails	8.93	17.28	4.85	.21
Consumption, imported tin plates	2.37	3.99	7.58	11.39
Consumption, imported, other manufactured	14.51	7.43	6.56	7.09
Total consumption	86.29	150.76	196.64	286.89
Per cent. foreign	36.7	32.1	37.5	8.9

[The total consumption of pig iron was 7,748,817 tons in 1889 and only 3,409,211 in 1879. In the previous decade it nearly doubled, and in the decade before that, beginning with 1850, it was only 827,609 tons. The distinction between iron *consumed* and *produced* is to be carefully remembered. The rail consumption per inhabitant was 21 7 lbs. in 1869 and 50.7 lbs. in 1889.]

The apparent inference from such figures as these is that we are enormously outstripping all the rest of mankind, since it seems incredible that the iron production of the whole world can be advancing by such leaps and bounds; and it is a fact that we are advancing much faster absolutely than the rest of mankind, as is but natural from the fact that this is the youngest country, whose resources even now are but beginning to be developed. Yet the inference as a whole is a false one, because the European world has been advancing in iron production at a rate even more wonderful than our own, all things considered. To show to what extent this is true, we have with considerable trouble compiled from the publications of the American Iron and Steel Association the following large table, showing the pig iron production of the United States, Great Britain and the world since 1830, and since 1865 for each year, in *thousands* of gross tons of 2,240 lbs., with the percentages of each country of the total product. We have never seen a table quite like this, and it seems to us most interesting. The percentages and the gross tons for the United States were computed by the slide rule only, and may be in instances a unit, or even more (for the gross tons), in error in the last digit, but this insensibly affects the general comparison.

PIG IRON PRODUCTION OF THE WORLD SINCE 1830.

Year.	Thousands of gross tons.				Percentage of total.			
	U. S.	Brit.	Other.	Total.	U. S.	Brit.	Other.	Total.
1830	165	682	621	1,468	11.2	46 5	42.3	100.0
1850	565	2,250	1,935	4,750	11 9	47.3	40.8	100.0
1856	789	3,586	2,625	7,000	11.3	51.2	37.5	100 0
1865	831	4,825	3,504	9,250	9.0	52.2	38.8	100.0
66	1,206	4,524	3,570	9,300	13.0	48.7	38.3	100 0
67	1,305	4,761	3,784	9,850	13.3	48.3	38.4	100.0
68	1,429	4,970	4,001	10,400	13.7	47.9	38.4	100.0
69	1,708	5,446	4,421	11,575	14.8	47.0	38.2	100.0
1870	1,665	5,964	4,271	11,900	14.1	50.1	35.8	100.0
71	1,708	6,627	4,165	12,500	13.7	53.0	33.3	100.0
72	2,545	6,742	4,658	13,925	18.3	48.4	33.3	100.0
73	2,560	6,565	5,549	14,675	17.4	44.8	37.8	100.0
74	2,400	5,991	5,109	13,500	17.8	44.4	37.8	100.0
1875	2,018	6,365	5,292	13,675	14.8	46.6	38.6	100.0
76	1,868	6,550	5,051	13,475	13.9	48.6	37.5	100.0
77	2,060	6,609	5,006	13,675	15.1	48.4	36.5	100.0
78	2,295	6,381	5,249	13,925	16.5	45.8	37.7	100.0
79	2,735	5,995	5,220	13,950	19.6	43.0	37.4	100.0
1880	3,835	7,749	6,366	17,950	21.3	43.3	35 4	100.0
81	4,144	8,144	7,112	19,400	21.3	42.0	36.7	100.0
82	4,623	8,587	7,540	20,750	22.3	41 4	36.3	100.0
83	4,596	8,529	7,875	21,000	21.9	40.6	37.5	100.0
84	4,068	7,812	7,565	19,475	21.0	40.2	38.8	100.0
1885	4,045	7,417	7,638	19,100	21.2	38.8	40.0	100.0
86	5,683	7,010	7,693	20,386	27.9	34.4	37.7	100.0
87	6,417	7,560	8,194	22,171	29.0	34.1	36.9	100.0
88	6,490	7,900	8,578	22,968	28.3	34.4	37 3	100.0

SUMMARY BY HALF DECADES.
Thousands of gross tons.

1830	565	682	621	1,468	11.2	46.5	42.3	100.0
1850	565	2,250	1,935	4,750	11.9	47.3	40.8	100.0
1856	789	3,586	2,625	7,000	11.3	51.2	37.5	100 0
1865	831	4,825	3,504	9,250	9.0	52.2	38.8	100.0
1870	1,665	5,964	4,271	11,900	14.1	50.1	35 8	100.0
1875	2,018	6,365	5,292	13,675	14.8	46.6	38.6	100.0
1880	3,835	7,749	6,366	17,950	21.3	43.3	34.4	100.0
1885	4,045	7,417	7,638	19,100	21 2	38.8	40.0	100.0
1888	6,490	7,900	8,578	22,968	28.3	34.4	37.3	100.0

It will be seen at once from this table, and especially from the summary below it, that the pig iron production of the world (which means also the consumption, taking the whole world together) has increased in almost as remarkable a ratio since 1856 as that of the United States per inhabitant has increased since 1859. The world's production (and consumption) has increased to 328 per cent. of what it then was; the consumption of the United States per head has increased in practically the same period (1859 to 1889, instead of 1856 to 1888) by almost the same amount, or to 332 per cent., of what it then was. Therefore, vast as is our progress in this industry, we are making no phenomenal progress. The world is keeping fairly even step with us. The fact which we are apt to forget in studying comparative industrial statistics is that our population has increased in wholly unprecedented ratio, both from natural increase and immigration. Between 1840 and 1880 the population of this country tripled; that of Europe west of Russia increased only one-fourth part. In 1840 we had only 9.35 per cent. of the population of Europe west of Russia (17 against 182 millions); in 1880 we had 22.1 per cent. (50.4 against 228.5 millions). In other words, our population relatively to that of civilized Europe is now about 2.36 times as great as it was 40 years ago, while our percentage of the total iron production has only increased 2.38 times (from 11.9 to 28.3 per cent.).

These facts show that the rate of progress of the countries whose political and economic condition we are in the habit of commiserating compares most favorably with our own. In the great race of the English-speaking race, as a whole, against the field, the former seem to have every advantage. They have the most abundant and best supplies of coal and ore, stronger and better workmen (as they think), two-thirds of the merchant marine, free institutions and no burdens from standing armies; yet the table above will show that continental Europe has held its own with remarkable persistency since 1830 with about three-eighths of the total product, the variations from first to last being too small to have significance. The introduction of the protective policy on the Continent, which is of comparatively recent date, does not seem to have affected its proportion of the total iron output of the world either one way or the other.

As between Great Britain and the United States, we have certainly been overhauling her most rapidly in the last few years. In two or three years more we shall be ahead of her in pig iron production, unless all signs fail. Yet a brief examination of the figures will show that we deserve less credit, and England less discredit, from this fact than might at first sight appear. In the first place, it was not until 1878 that there began to be any serious falling off in England's proportion of pig-iron production. Up to that time its proportion of total production had been pretty steadily 48 per cent., without any fluctuations of much significance. Now, it was about this time that the world's production took a sharp and sudden jump, rising in three years' time, 1878 to 1881, from about 13,500,000 tons, where it had stood for nearly a whole decade, to about 20,000,000 tons, where it has now stood for nearly a decade, only lately beginning to rise seriously above it. In so sharp and sudden a change in the world's demands (not alone in the demands of this country), with almost every English coal and ore deposit of special value already in working, and with a whole continent of such deposits on this side of the water, of the finest quality and as yet hardly scratched, where should the increase go to? It could hardly have helped going elsewhere for the most part in any case, or, at least, it is not surprising that it should largely have gone elsewhere; and hence it happens that although the English product jumped up immediately in the three years above referred to from 6,500 to 8,000 tons, so that the English percentage decreased in those three years only from 46 to 42 per cent., yet this sudden increase has been only partially maintained, while the further increase in the world's demands has been met chiefly from this continent.

In our natural exultation at great material progress we should not lose sight of these facts, nor hug the delusion to our souls that we are really outstripping all creation. Continental Europe, all things considered, is distinguishing itself in the iron industry far more than we. England, all things considered, may fairly be said to be doing the same, especially if we remember that the whole civilized world is fighting against her by tariffs. In fact, we have only to examine the records to see that all our boasted recent progress is after all only recovering lost ground—only bringing us back to where we stood half a century ago—if the difference of population be duly remembered; a vital fact which is continually lost sight of in jumping at conclusions from industrial statistics.

Thus in 1830, in our then raw, poor country, we made only 165,000 tons of iron, which seems small indeed compared with the 6,490,000 tons of '88, only a fortieth part. But then England itself only made 621,000 tons in 1830, or only four times as much as we. This proportion we maintained in substance up to 1856, in spite of the deadening effect upon all enterprises of slavery and our uncertain political future. Now, in 1830 we had barely half the population of Great Britain (12.9 against 24.1 millions). In 1880 we had *a half more* population (50.41 against 34.65 millions). If, then, in 1830, we made a quarter as much iron with half the population, how much should we have made in 1878 to keep up our end of the contest? Plainly, about three-quarters as much, considering increase in population only, without considering our much greater relative progress in conditions favoring large industrial enterprises, which, in 1830, were poor indeed.

As a matter of fact, we produced only 36 per cent. of the British product in 1878, instead of the 75 per cent. which due proportion called for; in 1880, only 48 per cent; in 1885, only 54½ per cent.; and in 1888 only 82 per cent., which is certainly no greater a percentage in proportion to population than was our output of 1830. But population alone is not the true standard of comparison. Our comparative wealth, transportation facilities, assured political future, and other like differences of condition are also to be remembered; and keeping this in view, it is impossible to deny that our progress since 1830–56, while absolutely great, is marvelous only as that of the whole world is marvelous. Relatively, we have failed to keep step even with the British rate of progress, and still less with the Continental.

The interpretation to be put upon these facts it is not our province to consider. Both the protectionist and the free-trader will, doubtless, find in them arguments to support his views. This journal, not being political, must content itself with showing the facts of record, and with pointing out that the facts do not justify us in crowning our own heads with laurels for achievements in iron production. Since 1878 we have been gaining upon England, indeed, but in so doing we are as yet only recovering lost ground, for we are not even now so strong proportionately as we were half a century ago.

The Louisville Tornado.

The great disaster at Louisville, and in surrounding parts of Kentucky, is one almost without parallel in magnitude on this continent. As great or greater tornadoes have occurred, for there is no other part of the globe which is so subject to tornadoes as the upper central part of the Mississippi basin, as will be seen from the map in another column, but rarely have so many lives been lost. In all parts of Europe tornadoes are practically unknown.

As nearly as we can judge from the reports, the total lives lost by this storm number not less than 150, 93 of them in Louisville alone.

According to signal service records recently made public, the total loss of life known to have occurred in the United States up to this time, from the beginning of its history, was about 3,000 killed and as many more injured, and the total number of tornadoes before this one, which have caused the death of so many as 100 persons has only been four, the two worst of all (by a singular and suspicious coincidence, leading one to suspect that there may be some error in the record), having happened at the same place, Adams, Miss., and within two years of each other. The first of these, May 7, 1840, caused the death of 317 persons, with 109 injured. The second one, June 16, 1842, resulted in 500 deaths. It was not till April 18, 1880, that again so many as 100 were killed, which was at Barry, Mo., and vicinity, 101 deaths and 600 injuries. The only remaining instance where 100 were killed was at Powesheik, Ia., June 17, 1882, where 100 were killed and 300 wounded, 260 houses being blown over.

Besides these there have only been two other tornadoes which caused the loss of 50 lives, only one which caused the loss of 40 lives, and only three of 30 lives. The notable fact in connection with this record, explaining why the Louisville catastrophe shows such great fatality, is that never before has a tornado happened to strike a city of any size. The largest American town ever before afflicted by a serious tornado was New Haven, Conn., Aug. 9, 1878, when 34 were killed, 28 injured, and 160 houses destroyed. But New Haven at that time had less than 60,000 population, whereas Louisville has now nearly 200,000.

If we consider how extremely narrow is the path of such tornadoes, it is not wonderful that they seldom strike large cities. Gen. GREELY states, in his interesting work on "American Weather," that the path of greatest violence (outside of which there is seldom great disturbance) varies from 300 to 1,800 ft. in width, and from one to 50 miles in length, the average rate of advance being from 20 to 50 miles per hour. The Louisville tornado followed this law closely, as will be seen from the map in another column, cutting a swath 1,500 to 2,000 ft. wide only. The Louisville tornado also agreed with 80 per cent. of American tornadoes in having a course from southwest to northeast. About 10 per cent. only move from the northeast to southwest, and the remainder in various directions.

As will be seen from the map above referred to there is no part of the United States east of the 100th meridian which is exempt from danger of tornadoes except a narrow fringe of sea and lake coast, but they are very frequent only in Georgia and the Mississippi Valley, and vastly more frequent than anywhere else in two small areas centering in Kansas City, Mo., and Springfield, Ill., where as many as 50 are recorded in the 87 years between 1794 and 1881, or more than one every other year. It is a curious fact that the path of the storm center of the late great storm, as shown on our map, was almost precisely through these two centers of most frequent tornadoes. In fact, at the very moment that the tornado was occurring at Louisville, just before 8 P. M. of Thursday night, the storm centre was at Springfield, Ill., with the extraordinarily low barometer of 29.08, the isobars for each 0.1 in. of barometer being grouped around it in vast horseshoes open toward the southeast, or toward Louisville, where the barometer was 29.28. The 30.0 isobar went through Sault Ste. Marie, Duluth and central Kansas and Nebraska. These conditions corresponded to what, so far as known, are the invariable conditions of American hurricanes, viz., that they occur to the southeast of the advancing storm, which always (when a continental one) advances from west to east.

The region in which tornadoes are very frequent is a limited one, however, and Louisville is not in it. So far as can be judged from the map about fifteen tornadoes per century only is the fair proportion for Louisville. Moreover, this does not mean, if we understand the map correctly, that any one particular spot in or near Louisville is likely to to be subjected to 15 tornadoes per century, but only that number is likely to be reported from somewhere in its vicinity—a very different matter. It is evident from this fact that the map can show nothing absolutely as to the probability of a tornado striking any particular spot. It can only indicate comparative frequency, and that but roughly. For example, there is certainly an area of 10 miles square, or 100 sq. miles within which, should a tornado occur, it would be classed as a "Louisville" tornado, yet the actual area affected by this last most violent tornado, as shown by the small map in another column, was barely 3 per cent. of the built up area of the city, and even in this district the destruction is far from complete. The buildings at the corner of blocks, for example, were pretty generally wrecked, but those in the centres of blocks were comparatively little injured. But for this, the loss of life would have been far greater than the 93 which it is now reported covers the total.

Another certain fact in regard to these tornadoes is that their violence is far ahead of that which can result from any rectilinear motion of air, however rapid. Their path, therefore, is not the mere centre of a disturbance, which gradually shades off into calm air, perhaps hundreds of miles off; but within a few hundred feet the difference is as between an irresistible energy and a high but comparatively harmless wind. From this it will be seen that, in spite of the fact that nearly the whole Mississippi basin is subject to 10 or 50 tornadoes per century, the chance of any one particular building or spot of ground being struck by a tornado is extremely small, so much so that the danger almost ranks with that from earthquakes, which has to be simply neglected in ordinary calculations. Only in this way can it happen that in spite of these frequent tornadoes the West is, as a whole, so prosperous. There is no way of dctermining the fact precisely, but the probabilities are that if all the areas in the United States which have ever been passed over by a tornado (*i. e.*, within historic times) could be collected in one spot, they would not make a good sized dot on a pretty large map of the United States; and the total loss of life, property and crops from them is probably vastly less than has resulted in the aggregate from the ordinary high winds which occur everywhere every few weeks, but cause no such destruction at any one time and place as to attract much attention.

These thoughts may enable those who did not suffer from the great tornado to hear its consequences with more equanimity. Those who did suffer from it will not be so easily consoled; but all alike may find legitimate consolation in the fact that it is a kind of disaster against which the resources of man are helpless, and hence for which no one is to blame.

Notes by Rail.

[EDITORIAL CORRESPONDENCE.]

I left Philadelphia on a very stormy morning, taking the Philadelphia & Reading's morning express up the Schuylkill Valley. It is well known, of course, that this is the main line of the Reading system, over which the bulk of its coal product goes to market from the mines. The traffic over it is very heavy, and coal cars, if I mistake not, are a class of rolling stock not especially easy on the road bed. I was surprised, therefore, to find the road in remarkably good condition. The whole run to Pottstown is made at about 36 miles per hour, but the very numerous grade crossings, runs through yards, etc., where the speed comes down to 10 or 15 miles per hour, makes the actual running speed on the open road sometimes as high as 45 miles per hour, giving a fair chance for the engineer passenger to criticise the trackmen's work. One reason for the excellence of the road is probably the heavy rail, weighing 72 lbs. or more.

It had been raining for two days up in the mountains, and the Schuylkill River was the color of chocolate, rushing along bank full with I-don't-know-how-many grains of sediment in every gallon, to quench the thirst and tickle the palate of all Philadelphians who drink water. Every drinking and thinking citizen of Philadelphia ought to take an excursion up the Schuylkill Valley at some time when the river has been swollen by a day or two of rain, and as he notices the populous villages all along its banks for a hundred miles which pour their sewage into the swift current, let him consider that he and his brother Philadelphians form, at present, a sort of receiving basin for the waste of the whole Schuylkill Valley.

I looked for the Schuylkill Canal, which an enterprising syndicate were anxious to have Philadelphia purchase a month ago, as a source of pure water supply. At two or three places I saw a short stretch of a hundred rods or so, and I saw several locks in the river. It seemed evident that the line of demarcation between the impure water of the Schuylkill River and the pure (!) mineral (!) water of the Schuylkill Canal could only be located by a Philadelphia lawyer.

The coal trains which we passed seemed to be largely made up of heavy 8-wheel, hopper-bottom gondolas. The old 4-wheel coal cars, which for so many years rattled cheerfully along over the road, and were endured as a necessary evil, have about disappeared from the main line except on construction trains, where some of them are wearing out their last days. A car which seems to be fast growing in popularity among the coal roads is the style with the tubular iron side frame. I saw many on the Reading, and they seemed to stand up well under their load.

Our train's first stop was at Phoenixville, and I regretted that my arrangements did not permit a stop to visit the bridge works at that place. At the company's Philadelphia office, however, I was told that the Needles bridge, which the company is building at The Needles, Cal., on the Atlantic & Pacific Ry., is nearly completed. The shops are now busily at work on material for the bridge across the Ohio river from Louisville, Ky., to Jeffersonville, Ind.

We reached Pottstown on time, and I regretfully got off the train, for my first impressions of Pottstown were not especially favorable. However, the place improved on acquaintance, and in the few hours that I spent there I saw several things of interest.

At the Pottstown Iron Works the blast furnace had just been tapped, and the little river of glowing molten iron was rushing along down its sandy bed and spreading out in small rectangular lakes. Whoever first called them "pigs" must have had an eccentric and not over accurate imagination. In the rolling mill a big "bloom" emerged from the furnace in the shape of a white, hot rectangular block, weighing probably about a ton, and was put through the universal mill. The first few passes back and forth seem to have little effect on the thick mass, and it falls from the rolls at each pass with a heavy crash on the roll table. As it gets thinner, however, the enormous squeeze begins to tell, and it rapidly lengthens and grows thinner until it lies on the floor a finished plate about 40 ft. long and ⅝ of an inch in thickness.

Just adjoining these works are the shops of the Philadelphia Bridge Co. Here I saw several of the heavy girders for the Lake St. elevated railway in Chicago. A somewhat novel piece of plate girder work has recently been completed at Trenton, N. J., carrying a canal across the four tracks of the Pennsylvania R. R. It is practically a big iron trough, the girders forming the sides. Singularly enough no rolling load was specified for this structure.

In the yards I saw one of the wrought iron turntables illustrated in ENGINEERING NEWS some months ago all ready for shipment. It is a surprisingly big structure and makes one realize "the growth of the locomotive" about as much as the machine itself. The rollers on which the centre of the table turns are chilled cast iron, so hard, I was informed, that the hardest steel tool won't work them. I have since then seen some steel which is guaranteed to take a good shaving off any material yet discovered, and I am now anxious to get this irresistible force and immovable body together and observe the results.

At Ellis & Lessig's nail mill, on the outskirts of the town, I found quite an extensive plant, giving employment to about 600 men. An addition was erected last summer, giving room for 12 more puddling furnaces. The only especially novel feature I saw was a gas producer, making fuel gas for use in the furnaces.

As the process of nail making may not be familiar to every reader of ENGINEERING NEWS, a word or two on it may be of interest. By the common processes of puddling, rolling and shearing the pig-iron is converted into wrought-iron plate of a width a little greater than that of the nail to be made, and a thickness in proportion to the size of the nail. This nail plate is "fed" to a machine, which, at each closing of its jaws bites off a nail, upsets one end for a head, and gives it a properly shaped body. Nail plate for spikes and large size nails is heated before cutting, and is fed by hand to the machine. Nails of smaller sizes are cut cold, and the machine feeds itself when once the plate is put in its jaws. Boys keep the appetite of these smaller machines supplied, and one skilled workman looks after the knives and dies of four or five machines. After cutting, the nails are "blued" by passing them them through a heated hollow cylinder; where they get hot enough for a thin coating of oxide to form. The dull polish of the small nails and brads used for joiner work is given by "tumbling" the nails in a hollow revolving cylinder, where they wear themselves bright. A nail which will stand clinching nearly as well as a wrought nail is made by subjecting the cut nail to an annealing process.

READING AND ITS RAILWAYS.

All the way from Philadelphia up to Schuylkill Valley the railway has an easy grade, but just before it reaches Reading there comes a sharp climb. The track swings around the foot of Neversink Mountain, runs past the great mound of slag at the Reading Iron Works, and is in the midst of the city of Reading.

The city is located principally on an undulating slope, on the east of which Penn Mountain rises to a height of about 1,200 ft., while on the south, Never sink Mountain rises to about an equal height. A steep cable incline railway is already in operation, running to a summer hotel near the top of the mountain, but two railways of much more interest from an engineering point of view are just being completed, which will give access to the highest points of each of these mountains.

The Mt. Penn Gravity Ry. has a total length of 7½ miles. Of this the first two miles has an average grade of about 6 per cent. with a total rise of 658 ft. This portion will be operated by Shay locomotives (a type of engine in which gearing is used to gain power at the expense of velocity). From the summit the road descends over grades of 1⅞ per cent. to 5 per cent., and curves as sharp as 75 ft. radius to a terminus at the starting point, a distance of about 5½ miles. The locomotive backs down the two-mile grade, passing halfway down the ascending train. It is expected that a three-car train can be started from the terminus every 15 minutes. The cars are to be 8-wheeled, carrying 72 passengers, and will have hand brakes, with a shoe on every wheel. Besides the tourist traffic, it is expected that the road will carry suburban passengers, and a valuable stone quarry on the mountain will secure an outlet over the road.

The railway on the Neversink Mountain is now approaching completion, and will be ready for traffic as soon as the summer tourist season opens. It will be about 8 miles long, operated by electricity throughout. It winds around the mountain, reaching all the principal points of outlook, and finally returns to the starting point. Sprague motors will be used on the cars, and the dynamos will be run by the water power at the dam of the Schuylkill Navigation Co., a lease of which has been taken by the railway company. The road is being substantially built of standard gauge, and is so connected with the Philadelphia & Reading tracks

that a car and locomotive can be switched onto the line and can make the whole trip over it.

THE PHILADELPHIA & READING SHOPS.

The locomotive shops of the Philadelphia & Reading Company were located in the midst of the city of Reading many years ago, and the mistake was made of securing too little land for the work to be done. At present the shops have about all they can do to attend to the repair work alone, and new locomotives have to be purchased. The Baldwin Locomotive Works are now turning out 50 engines for the company. Fifteen of these are 10-wheel fast freight engines built on the same designs as the 10-wheeler which has given such satisfaction on the Erie, but with the Wootten fire-box.

Of course the financial troubles of the Reading have sadly hampered its mechanical department, and plans for the extension and improvement of the shops, with a view to doing work with greater economy, have had to be laid one side. A poor railroad, like a poor man, is often obliged to make a present saving at the spigot, regardless of the fact that a waste at the bunghole is certain to follow.

However, it is hoped and believed that brighter times are in store for the Reading. When they come, the present locomotive shops will perhaps be abandoned and new shops will be erected at the north end of the city, where the company owns a large tract of land.

Nearly half the Reading locomotives are now equipped with Wootten boilers, and they are put on all new engines. For burning buckwheat coal there is no doubt that the Wootten boiler is a great success. The Reading Co. estimates the cost to them of this grade of fuel at 30 cents per ton, which is so cheap that no determination of the evaporative duty has ever been made. On the engines in passenger service, however, ordinary coal is used. Tests were made about 10 months ago on the fuel consumption of a Wootten locomotive and a Strong locomotive. The run was from Philadelphia to Bound Brook and return. The Wooton locomotive required 7.6 lbs. of coal per car mile, and evaporated 5.07 lbs. of water per lb. of coal. The Strong locomotive used 8.22 lbs. of coal per car mile, and evaporated 5.5 lbs. of water per lb. of coal. Neither of these records are good enough to brag over much; it shows for the Wootten that it is at least not espe; cially wasteful as a coal burner. If it does as well as the above in everyday practice, it probably does better than the average firebox between the frames.

The company is now experimenting with an artificial fuel consisting of cubical blocks of coal dust pressed together with pitch. If this sort of fuel can be burned at all under the forced draught and intense heat of a locomotive fire-box, the Wootten boiler ought to be able to do it. One trouble with artificial fuels of this sort has been that the block disintegrated in the intense heat of the furnace, and the blast carried the pieces into the front end or out of the smoke stack, which was not exactly conducive to economy of fuel, to say nothing of the danger to buildings along the line. With the Wootten boiler there has been less trouble of this sort, owing to the large grate area; but the burning coal has given trouble by settling down on the grate-bars and choking the draught. A rocking grate-bar is to be tried to break up the crust which forms without the waste due to the use of the slice bar.

Some heavy American type passenger engines, with straight boilers, now in the shop, have given considerable trouble by hot bearings. The engine was designed for heavy service, and it was necessary, of course, to put as much weight on the drivers as could safely be carried. In this case the thing was a little overdone, and whenever the engine got up to a little extra speed the result was a hot box. The engines of this type are to be rebuilt with a Wootten firebox and the load on the drivers is to be lightened.

A chemical laboratory was started about a year ago, and as fast as possible standard specifications for the purchase of supplies are being prepared and put in use. This department is in charge of Mr. DOOLITTLE, who was formerly employed in the test department of the Pennsylvania R. R. at Altoona.

The car shops of the company are located in the north part of Reading, and here, also, nothing but repair work is now being done. As noticed some time ago in ENGINEERING NEWS, the Pullman Company is building several thousand cars for the Reading. The contract calls for 1,000 box cars, 50 passenger coaches, and the remainder double and single hopper coal gondolas. All are to be equipped with the Van Dorston automatic coupler, one of the M. C. B. standard type.

Nothing has been done in the way of improved car-heating methods yet, except to equip a few coaches which are used on the through Baltimore and New York line over the Baltimore & Ohio, Philadelphia & Reading and Central R. R. of New Jersey. About 400 cars are still running equipped with the old-fashioned suspended heater, but no new cars have been equipped with it for a long time. Its chief virtue was the somewhat problematical one of safety in case of disaster, it being supposed that the shock of an accident would knock the heater off, and it would be less likely to set fire to the wreck than if it were inside the car. Its faults lie chiefly in its enormous consumption of coal, and in the impossibility of attending to the fire during long runs.

The nickel-plating department of the shops seemed to me to be especially worth notice. All car trimmings, etc., which have a nickel finish are brought in here when the car is repaired and are replated. In one room was a silver-plating apparatus for silvering locomotive headlight reflectors, also a machine for burnishing them. The reflector is mounted in a chuck, so that the axis of the parabola coincides with the axis of the chuck. It is then revolved by a belt and pulley and the burnishing tool is carried along over the whole surface.

[TO BE CONTINUED.]

CORRESPONDENCE.

The Proposed Lake Superior and Michigan Canal.

MILWAUKEE, WIS., March 26, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: I have followed the discussion of the Lake Superior and Michigan Canal, contemplated to be built from either Au Train Bay to Little Bay De Noc, or Munising to Big Bay De Noc, and have always considered it more of a huge joke on paper than anything else; but since reading your last issue I have concluded that somebody is thinking very seriously of it.

In 1873 I was connected with the survey of the old Marquette & Macanac Ry. Our line ran about 6 or 7 miles from Au Train Bay and Munising, and consequently the levels gave a pretty good idea of the height of water shed between Lakes Superior and Michigan. Although it was 17 years ago, yet I am quite positive that the elevations were between 200 and 300 ft. above Lake Superior at those points, and from the nature of the country and from my knowledge of the Lake Superior watershed, I should not expect to find the summit between the two lakes less than 300 ft. if not more.

I remember this about the survey, viz.: That taking the side hill of the country to make the summit between Lake Superior and Lake Michigan, at St. Ignace, we were compelled to use 66 ft. grades, and this summit was southeasterly from Munising, and the height of the summit rises quite materially the further west you go.

If the summit to be overcome should prove to be as much as 300 ft. above Lake Superior, and as Lake Michigan is 23 ft. lower than Lake Superior, the total elevation to be locked up and down would be 623 ft. This would require 31 locks as large and as expensive as the one now being built at Sault Ste. Marie, besides 46 miles of canal to construct. As there is no material along the route which the United States would think of using, it would be necessary as a preliminary step to construct a railroad to transport material. A great difficulty, I think, would be to get sufficient water to operate the canal after it was built.

Of course the canal is not a necessity, and it would only become useful by saving time in passage of vessels from Marquette to Lake Michigan, bound for lower Lake Michigan ports. Tonnage bound for the lower lakes would not gain anything, and would not use it. Therefore the canal and locks should be built and supplied with all the facilities possible, or it would be of no use. With the greatest facilities possible, the time that would be consumed in passing 31 locks, together with delays, would be far greater, in my opinion, than that consumed now via Sault Ste. Marie. The tonnage any way, from Lake Michigan to Lake Superior, is not great, and the greatest tonnage from Superior to Lake Michigan is iron ore, and the bulk of that comes by rail to Green Bay.

I think Mr. Goodhue must be very far from facts when he estimates the cost of the canal at $8,000,000 to $10,000,000. The locks, certainly, would each cost as much as the one now being constructed at the Sault Ste. Marie, and any estimate that would cover the cost of a canal that would be of any utility should be not less than $75,000,000. I have spent a great many years in the Lake Superior County, and I know that any man who expects to build a canal from Lake Superior to Lake Michigan for $10,000,000 talks simply nonsense. It might be a good place to reduce our national surplus, but for any further utility it will never be realized.

Yours truly,

E. M. SPALDING, C. E.

[As Mr. SPALDING intimates, the cost of execution and service weighed against the advantages of a completed canal over the route suggested should decide its fate. As we understand it, no full surveys have yet been made, and the controlling conditions are yet practically unknown. But if these conditions are anything like those outlined in the present letter, vessel owners will probably be compelled to adhere to the Sault Ste. Marie route for some years to come.—ED. ENG. NEWS.]

The Walnut Grove Dam Failure.

SAN FRANCISCO, March 24, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: I gladly avail myself of the invitation conveyed in your editorial article of March 8, relative to the failure of the Walnut Grove Dam, which I have just read.

Concerning Col. ROBINSON, the statements attributed to me in the San Francisco *Chronicle* of Feb 23 were never made in connection with that gentleman, nor did I subsequently make any retractions. My letter of the 24th to the same paper was made voluntarily before having seen any of Col. ROBINSON'S friends, and was an unsolicited effort upon my part to rectify an injustice for which I was not responsible.

Relative to my connections with the work, I was engaged here by Mr. BATES to act as Chief Engineer for the company and was informed that my duties were, aside from general advice, to complete the unfinished dam and survey and locate a flume line below the dam.

I reached Walnut Grove July 31, 1887, and took formal charge of the dam Aug. 10. During these ten days the work was practically left to the contractor to do as he pleased, and I was informed that it had been so for the past month. During this time the dam was raised about 20 ft. in height; this is the bad work mentioned in my account of the dam (see page 76, "Proceedings of the Technical Society, Pac. Coast, 1888"), where I say:

"And of the dam as originally built during a month's interval when there was no chief engineer some very bad work was done (see Fig. 2, left side of wall near middle). I advised the company to cut a large waste way and put the loose rock below the dam to strengthen this weak place."

After I took charge of the dam an assistant was detailed to inspect the work, and the terms of the contract were strictly complied with. Meantime, I was engaged in surveying a flume line, but I periodically inspected progress of the work (at least once a week until its completion).

"An examination of high water marks near and below the dam showed that ordinary flood discharge was about 10,000 cu. ft. per second, and evidence existed that at no remote period the discharge was perhaps as great as 25,000 cu. ft. per second. I explained to the manager the danger that would follow from the coincidence of a full reservoir and heavy flood, unless ample provision of waste way was made. The matter was freely discussed, and I think fully comprehended.

I left the service of the company before work on the waste way was begun, and have since been informed that its dimensions were about 5 ft. deep and 20 ft. wide. Upon leaving I gave the manager, in pursuance of agreement, a detailed report, in which they had the benefit of all the information of interest to them which I had acquired while in their service, and the same may be published by them if they wish to do so. I hope the unfortunate lessons of Johnstown and Walnut Grove may result in an official system of inspection of plans and execution of work, with periodical inspection thereafter of all work where water is to be stored in quantity sufficient to endanger life or property below it.

Very sincerely. LUTHER WAGONER.

The Chicago Exhibition Building.

NEW YORK, March 31, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: I have read in ENGINEERING NEWS of March 29, with much interest, the letter of E. S. Jenison & Co., architects, of Chicago, in reference to their proposed exhibition building. While I agree with them that it is, as they say, "the cheapest building that ever was," I doubt its economy.

So far from the central tower costing less than one standing alone, on account of its being stayed by the roof cables, its size and cost is increased by the load put upon it. The roof hung to it puts it in the position of the central pier of a suspension bridge having two spans of 1,500 ft. each, each span carrying 92¼ acres of roof. When we calculate the weight of this, and the unequal loading caused by wind pressure, we shall find that the vertical columns of such a tower would have to be from eight to

ten times as large as those of a similar tower standing alone.

So much for the tower, now as to the roof being "reduced in weight by having the tower to support its centre at a great altitude, so that it may be carried by cables in tension, the most economical use of material." I doubt this.

For this is as one should say that a building 3,000 ft. wide could be more economically spanned by a roof supported by one column than by 60 columns, 50 apart and of moderate height.

Mr. Jenison's figures at $35,000 per acre are entirely too small, when the necessaries to prevent the whole structures from collapsing under a moderate gale, are taken into account. The wind pressure at 30 lbs. per sq. ft., when on one side would be between 50,000 and 6 ,000 tons!

To consider the question from a broader point of view. What is the use of constructing a room 1,100 ft. high in the centre, without columns, when our experience of past exhibitions has taught us this:

After the architects of an exhibition building have finished it, no matter what heights and lengths of spans of roofs are given, the exhibitors immediately divide the space into a series of small compartments, generally about 30 ft. square, and roof them with some woven fabric, at a level of about 25 ft. above the floor.

Why do they always do this? Because they have well seen, that to bring out the qualities of their exhibits requires close examination, and it is better that each exhibit should be separated from the others, and the eye confined to what is in that special room, rather than be allowed to stray at will over a vast space. Also, the walls are found very convenient for hanging flat exhibits upon.

There can therefore be no possible need for avoiding the use of columns, as they are not only unobjectionable, but actually of use in supporting the partitions.

When we come to consider height we want enough to allow of a sufficient body of air for breathing while the ventilators are temporarily closed, and also for the sake of appearance. A roof 50 ft. high will do this. Such a form of building will accommodate all exhibits, except large machinery and tall trophies of metals, ores, bottles etc.

The best possible form of exhibition building for everything but works of arts and machinery is a square or circle divided by eccentric and radial passages, so to admit of the double system of classification by nations and by classes. In recommending this I agree with you entirely.

The objection is sometimes made to this form, that it is difficult to allot the required space to each nation. There is no serious difficulty, if the nations' spaces run radially and the classification concentrically, placing the classes farther and farther from the centre as more room is required.

Such a building should have a roof supported on columns placed at uniform distances of about 30 ft. apart. The height of roof need not be over 50 ft.

The roof should consist of ridges and furrows of 30-ft. spans. The side toward the south of some opaque material, aluminum, if you please, and the side toward the north of glass, obscured by canopies as at Paris, if the glare was too great. Ample ventilation should be provided by openings arranged so as to exclude rain during showery weather. Each column should contain a rain-water spout.

This main building should stand upon a basement high enough to admit box-cars and locomotives, and having tracks laid in passages corresponding with that above. Each compartment should have under it a similar avenue into which all goods could be delivered from the cars, unpacked and carried above by direct flights of steps. These basement rooms would be used to contain the packing boxes, and all those things not wanted during the exhibition. It would also contain all the drains, water pipes, electric wires, etc., etc.

The saving of time, trade and cost of handling, by this plan would I believe, pay for its extra cost.

In the centre of the building should be a large, clear, circular space covered with a high dome. To this all the radial passages would converge, and it would be used as a general meeting place and for musical concerts.

Such a building is better adapted for handling exhibits and receiving exhibits than many detached ones.

THOMAS C. CLARKE.

[There can be no doubt that our correspondent is correct in the claim that, for convenience of exhibits solely, nothing is better than a comparatively low, much sub-divided interior. We urged the same view earnestly in proposing a large exhibition building in stories for the New York exhibition. But in that case the building itself would furnish what we hold to be a necessity for even commercial success in such an exposition, a grand central feature exciting a legitimate and universal curiosity, in order to do which effectively it must be not simply gigantic, as would be some of the tall towers proposed to "outdo the Eiffel Tower," but of such a nature as to excite an intelligent interest in learned and unlearned alike. It is the lack of some such element as this which makes a vast expanse of one-story sheds seem a mistake even from the commercial point of view, and even if really the cheapest form of construction, and supplemented by some monstrous travesty of the Eiffel idea, such as alone have been proposed so far.

As for the remaining questions, we have no doubt that Mr. JENISON'S estimates are much too small for a building of his proposed size, as we intimated pretty broadly last week, but we find ourselves equally unable to follow our correspondent's position, granting what our premise has been from the first, that a tall tower is to be in any case a feature of this exposition, and, except by some such plan as that in question, is to be constructed purely to give elevation, without serving any other useful purpose. Taking any tall tower, there can be no doubt that, if appearance be disregarded, equilibrium can be insured much more cheaply by guying from the top, and perhaps from intermediate points, than by giving the necessary mass and spread at the base. By multiplying the number of guys still further, and carrying a roof on them, we shall undoubtedly much increase the load carried by the tower, and so its cost; but it appears to us possible to so design the structure that all dead and live strains sustained by the tower shall be vertical strains. If so, to roof a very large area, larger than has ever been covered by a roof before, at less cost than that of the cheapest shed building that would be proposed, *plus* the cost of an independent tall tower ought to be possible, and would afford two great advantages, viz.: (1) The tower becomes a respectable constructive feature instead of a vulgar excrescence, and (2) a grand interior and exterior is secured, which is none the less desirable because the individual exhibits are from preference inclosed as our correspondent describes. If a tall tower is not wanted, the conditions of the problem become radically altered.—[ED. ENG. NEWS.]

Earthwork Specifications.

CHICAGO, Ill., March 3, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: Some experience which I have gained lately has led me to the conclusion that the specifications of the leading railroads east of the Mississippi, for grading, so far as they relate to the classification of material in earth work, to say the least, are badly in need of a revision, if not subject altogether to an entire change.

The present system of classification is based entirely on methods employed years ago, when earth was moved by picks and plows, loose rock by bars, and quarrying and solid rock by black powder and block-holing. Since the introduction of dynamite and other high explosives, and relative cheapness of powder as compared with a number of years ago, the methods of excavation have changed greatly. Hardly a contractor can be found that does not use powder in earth cuts. Terrific charges of dynamite are used in solid rock, much to the detriment of the slopes, and consequent increase in quantities.

From the West Shore specifications, published and sold by your company, I make the following extracts:

Earth will include clay, sand, gravel, loam, decomposed rock and slate, stones and boulders containing less than 1 cu. ft., and all other matters of an earthy nature, however compact, excepting only "hard pan," as described below.

Hard Pan will consist of tough, indurated clay, or cemented gravel, which, in the opinion of the engineer, requires blasting for its removal.

Loose Rock.—All boulders and detached masses of rock measuring over 1 cu. ft. in bulk and less than 1 cu. yd., also all slate, shale, soft, friable sandstone and soapstone, and all other material, excepting rock, solid ledge and those described above; also stratified rock in layers, if not exceeding 8 ins. in thickness, when separated by strata of clay, and which, in the judgment of the engineer, may be removed without blasting, although blasting may occasionally be resorted to.

Solid Rock will include all rock in ledges, or masses of more than one cubic yard, which, in the judgment of the *engineer*, may be best removed by blasting, with the exception of stratified rocks described under the head of loose rock. Many railroad companies now fix prices for all work themselves, and then ask responsible contractors to take the work at the company's figures, which are the same for all portions of the line no matter how close to the base of supplies, geological conditions of the country passed through, etc.

Let us take a railroad, say 150 miles long. The first 50 miles might pass through a sandstone country, with loose sandy soil; the second 50 miles might be in a limestone foundation, with heavy soil, and the last 50 in shale or slaty material. Under the specifications quoted above, the contractor removing sand gets the same price as the one removing heavy clay and loam and even decomposed rock and stones less than one cubic foot, the cost of removal in the latter case being very disproportionate.

One contractor may encounter a hillside covered with small, loose stones, easily moved, and get loose rock for the same, while his neighbor quarries solid beds of slate and soft sandstone, which might be removed without blasting, *although blasting may occasionally be resorted to*, getting the same classification.

In my mind the sentence in italics is a senseless one; and has always been a bone of contention, and had better be expurged.

No difference is made between limestone and sandstone, the latter material being more readily moved.

In order to equalize matters, engineers are asked to give some loose rock in earth cuts—soft rock is partly classified as solid, etc.

These methods tend to a demoralization of the engineering department, and are to be deplored because they are not in accordance with the specifications, but it is considered easier to change the classification than the prices. In order to equalize these differences, I submit the following specifications:

Earth to include clay, loam, sand and all material of an earthy nature.

Loose Rock to include loose stones, rock and gravel containing three cubic feet and less, whether found in separate or contiguous masses.

Composite, a mixture of earth and loose rock. This material will be paid for at earth and loose rock prices, in the proportion as the two are found together. The proportion of each material to be judged by the engineer.

Hard Pan will include indurated clay and cemented rock, stone or gravel.

Soft Rock.—All slate, shale, soapstone and other soft rock subject to disintegration on exposure to the atmosphere, and which must be found in *situ*, and all other rock containing over three cubic feet, and less than one cubic yard.

Solid Rock will include hard rock which will ring under the hammer, and is found in compact and contiguous masses, and can only be removed by drilling and blasting. Only five classes of material will appear on the estimate sheets, composite being returned as part earth and part loose rock, as the case may be. CONTRACTOR.

[We agree with our correspondent that there is room for improvement in the classification of materials, basing this improvement on the changed methods of working. But from the very diversified nature of the earth's crust, and the intimate mixture of material easily and cheaply moved with other material difficult and costly to handle, any exact, hard-and-fast rule for classification is simply impossible. After all, the classification must be left to the judgment, experience and justice of the engineer. The engineer's decision, whatever it may be, is always liable to be disputed by the contractor, and some provision might wisely be added to specifications covering this point in a manner a little more acceptable to the contractor than the usual fiat—"that the decision of the chief engineer, on all disputed points, shall be final and binding." Engineers are human and hence are not infallible. It might be made a part of the contract, that in all cases of serious dispute, involving a stated sum of money, the contractor and the corporation shall each select an engineer, and these two shall select a third. These engineers shall constitute a board to examine and report upon the question in dispute and fix an award that shall be binding upon both parties. That good and experienced men only shall be appointed, the compensation of these engineers should not be less than $50 per day. If their award agrees substantially with the engineer's estimates, the contractor must pay the entire cost of this investigation; while if the engineer is at fault, the corporation must pay the bill. We believe that a clause of the nature of that here roughly outlined would go far towards checking the present crop of disputed measurements, disputes too often based on little or no cause. In cases falling in value below the fixed sum agreed upon, the engineer should decide as he does now. The whole question is an interesting and important one, but we do not believe that it can be settled by the wording of the specification clauses defining the material to be handled.—ED. ENG. NEWS.]

Notes and Queries.

C. F. K. wishes to purchase a good cement testing machine or work at a new bridge over the Ohio river, and desires information concerning them. The best papers on this subject were published in the Am. Soc. C. E. Proc. of 1885. There are several makers of good machines, and opinions of engineers are somewhat at variance as to which make is on the whole superior.

An Accident on Solid Ground.

The accompanying illustration shows a derailment which is instructive for two reasons:

First, and foremost, as showing how small the consequences of even the most serious and complete

An Accident on Solid Ground. Derailment near Pembroke, Ont., March 12, 1890.

derailments are likely to be when they occur on level ground or on low cuts or fills, and hence with what special care bridges and high fills should be protected if equal safety is to be obtained on them.

Secondly, as illustrating what the phenomenon is which is called "spreading of rails," which almost unvariably is an effect and not a cause.

The derailment occurred on a 3° curve on the Canadian Pacific Railway, at Graham's Station, a half mile only east of Graham's trestle bridge, a very considerable structure, at which, had the derailment occurred there, we should have obtained a very different picture. The train consisted of a locomotive, which remained on the rails, a tender and express car, which remained on the bank derailed, and a smoking car, day coach, dining car and sleeping car, which went down the bank and turned over on their side, and all appear in our view.

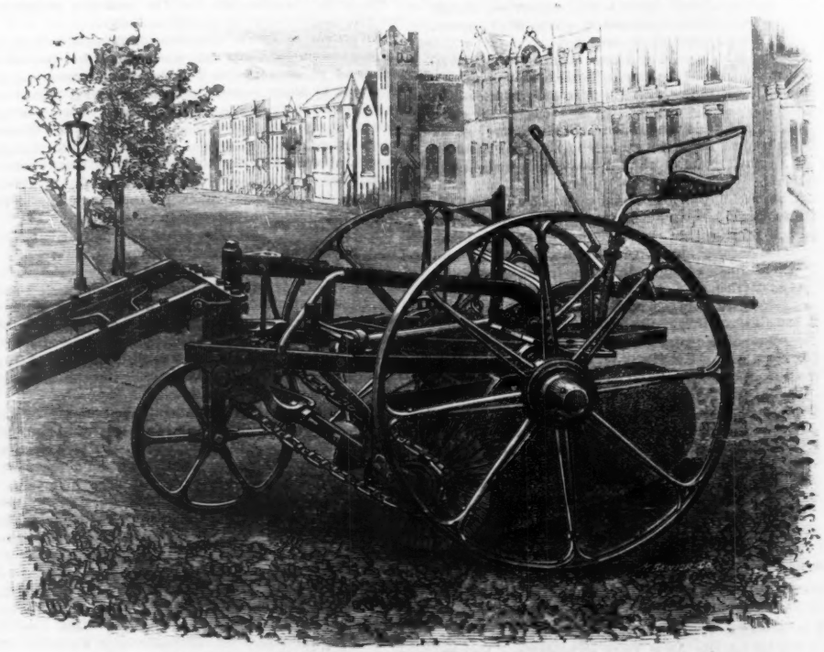
The train had left Pembroke, 224 miles from Montreal, at 9:15 A. M., March 12, 1½ hours late, and was probably running 45 or 50 miles per hour at the time of the accident, or 5 to 10 miles per hour above the usual rate between stations in order to make up time. Not a single person was injured, beyond slight bruises, and as will be seen from the view the cars were not at all badly wrecked. The bank would appear to be about 4 ft. high in the foreground, and perhaps 6 or 7 ft. in the background. Had the bank been 10 ft. higher the record would almost certainly have been much less pleasant to contemplate.

We deem that this distinction between localities in danger to derailed trains cannot be too forcibly impressed upon the minds of engineers and operating officers. The distinction is a vast one. Derailments anywhere are not pleasant occurrences, but experience has abundantly shown that on solid ground and low fills derailment even at the highest speed is a comparatively harmless amusement. It is the rare exception for any very serious harm to result, even if the train turns over on its side, as in our view. A few broken limbs and one or two persons killed is about the limit of casualties in the worst of such occurrences, except where stoves or lights cause fire to follow the derailment.

As regards the "spreading of rails" feature, it is pretty easy to see what occurred in this case. The overturning of the rail, which pulled nearly all the spikes out on the inside, as faithfully shown in our engraving, was from no normal pressure which could arise from wheels on the track, but from a derailed wheel which got a fair start on the inside and turned the rail over in a detail by a wedge-like action. The first derailment in all probability had no connection with any spreading of rails, but was merely one of the "unexplained" kind, the wheels jumping from a combination of unfavorable causes, no one of which alone was enough to cause derailment. Until roadbed, wheels and axles are absolutely perfect, and springs are no longer needed, we believe that these must always occur at times, but on strictly first class track they can be made extremely rare. It is obvious, however, that a spike of greater holding power might have greatly diminished the violence of this derailment, and perhaps averted all overturning of the cars.

The "Barnard-Castle" Wrought-Iron Street Sweeper.

The city of London alone uses 2,000 of the sweeping machines here illustrated, and it is said that over 6,000 are in use in total. As shown, it is built



The "Barnard-Castle" Wrought-Iron Street Sweeper.

almost entirely of wrought iron, and as a consequence possesses the important qualities of durability, lightness and handiness in use. Two sizes are made: one to sweep 6 ft., and the other 7 ft. 6 ins. in width. The first can be used with one or two horses, and is provided with either pole or shaft, as required; the second, being heavier, requires two horses. The smaller sweeper has a third, or front wheel, while the larger one has four wheels; both thus relieving the horse or horses of the weight of the machine and requiring less exertion to pull it.

The broom of the sweeper is provided with a universal joint in the centre, which allows the broom to accommodate itself to inequalities in the street surface, and insures cleaner sweeping than would be possible with a rigid shaft.

Mr. H. PERCY BOULNOIS, M. Inst. C. E., and City Surveyor of Exeter, in his practical treatise on the scavenging and cleansing of cities and towns, commends this "Barnard-Castle" machine, of which it is said that a 6-ft. machine will sweep from 8,000 to 10,000 sq. yds. per hour in fair work, equivalent to the work of 30 men in the same time. Mr. BOULNOIS further says that, owing to its simple construction, it costs little or nothing for repairs; and that one set of brushes lasts for 180 hours of constant work, and costs about $10 to fill with rattan, or much less if bass is used.

This machine, of which Mr. W. C. OASTLER, 43 Exchange Place, New York, is the American representative, is already in use in more than twenty American cities and towns, and a number have recently been ordered for New York City.

The same makers manufacture a road scraper for mud and snow, for which it is claimed that with one horse 8,000 sq. yds. of surface can be cleared per hour. This machine is likewise built of wrought iron, and can be regulated for pressure.

ENGINEERING NEWS.

THE PROPOSED KANSAS RIVER DAM AT TOPEKA, for the development of water power for manufacturing purposes, is thus outlined by Col. WILLIAM TWEEDALE. The drainage area of the Kansas River and its affluents is about 5,000 sq. miles. The rise of the country west of Topeka is 2¾ ft. per mile for the first 100 miles; 1.2 ft. per mile for the second hundred; 7.9 feet for the third; 10 ft. for the fourth and 14 ft. per mile for the fifth hundred miles. The dam at Lawrence, Kan., is 600 ft. long, with three-fifths of the base on rock and the remainder on sand. The minimum flow of the river at Lawrence is 2,200 cu. ft. per second; at Rocky Ford, five miles above Silver Lake, the following is 2,262 cu. ft. per second. Levels to Silver Lake, a distance of 5½ miles, show a head of 10 ft.; and to Soldier Creek, 15½ miles, a head of 34.6 ft. With a dam at Rocky Ford, with suitable head race and some dredging in Soldier Creek, an effective head of 42 ft. can be secured. This would give 10,794 nominal H. P. at 257 H. P. per foot of head. Deducting loss and power required along the line, the City Engineer of Topeka figures

3,000 H. P. at Topeka available, at a cost of $350,000, at $116 per H. P. Col. TWEEDALE bases his figures on 3,575 H. P. effective, and, allowing for cost of replacing steam power and introducing dynamos, wire work, motors, etc., sets the cost of works at $900,630. Allowing 6 per cent. for interest and 8 per cent. for attendance, insurance and depreciation the annual charge is $138,691; and this capitalized a 6 per cent. represents $2,311,516.

THE PROPOSED COLORADO RIVER DAM, near Austin, Texas, is estimated in cost at $1,370,000 by Mr. JOSEPH FRIZELL, C. E., of Boston, Mass. This price is for a 60-ft. dam, forming a reservoir on the river 30 miles long, and for piping, masonry and other plant necessary to supply water power for lighting the city, running street cars, manufactories, etc. The dam would supply 6,000 H. P., of which 1,800 H. P. would be devoted to city use and the remainder leased. The dam would be built of limestone rock with granite base and capping.

A NEW WATER IN-TAKE FOR MILWAUKEE is recommended by City Engineer BENZENBERG. In the report of the Commission of Engineers, two lines of 5-ft. pipe running 8,000 ft. into the lake were approved of. Mr. BENZENBERG now reports that, since the experts' report was submitted, borings have developed a heavy bed of blue, soapy clay, suitable for tunneling, underlying a solid bed of cement or lime rock. He says this clay could be easily and safely tunneled, and he suggests that a 7½-ft. tunnel be driven out 3,000 ft. to an intermediate crib and from that point two lines of pipe be run an additional 5,000 ft. This plan will take less time and can be carried out for $450,000, or $50,000 less than the present appropriation.

THE NIAGARA WATER-POWER TUNNEL, as designed by the late Mr. THOMAS EVERSHED, C. E., is now said to be an assured fact, through the Cataract Construction Co., organized under the laws of the State of New Jersey. The plan proposes a tunnel about 200 ft. long driven at right-angles to the river at a point about 1 mile above the Falls, when a head of 120 ft. is secured. From this intake a tunnel will run parallel to the river, and 400 ft. from it, about 100 ft. below the surface of water and connected with the river by conduits or lateral tunnels. The mouth of this tunnel will be immediately north of the State Reservation, and the area of the main tunnel will be equivalent to a circular, smooth tunnel 24 ft. in diameter. The tunnel will have a descent for its last half mile of 1 in 100. The mills will be on the lateral conduits and the tunnel will carry off the tail-water.

THE VERA CRUZ, MEXICO, BREAKWATER, now being constructed, is to be 3,428 ft. long and 100 ft. wide. The depth of water was supposed to be about 34 ft.; but it will exceed this by some feet, owing to the concrete blocks working through the sand to the clay bottom. The exterior wall, now building, is to be made of 28-ton blocks of concrete thrown in so as form a pile with a slope 1 to 1 on the outside and 1 to 2 inside. The top of the foundation is to be 20 ft. wide, to receive a wall made of three courses of blocks; the first course 16.4 ft. thick by 5 ft. high; the second, 13 ft. by 5¾ ft. high, and the third, 11 ft. by 5 ft. high. These courses are laid so as to form steps on each side of the wall. The inside wall is to be built of somewhat smaller concrete blocks in much the same manner as the outer wall. Between these walls will first be placed a covering of riprap on the inner slopes of the walls to make them tight, and then the whole space is to be filled with sand, amounting to about 333,000 cu. yds. The cost of the breakwater is estimated at $4,500,000, payable $5,000 per week from custom-house dues, and the remainder in government 6 per cent. bonds taken at 90. About 22,000 14 cu. m. blocks will be required, of which 8,000 must be laid in courses. The contractor is AUGUSTIN CERDAN.

THE UNITED STATES SENATE, on March 29, appropriated $3,738,000 for the improvement of St Mary's river in Michigan; $1,684,000 for the improvment of the Hay Lake channel, Michigan, and $6,200,000 for the completion of the entrance to Galveston harbor, provided not more than $1,000,000 per annum is expended on the latter work.

THE CONTROL OF THE CAPE COD SHIP CANAL is transferred by Mr. FREDERICK A. LOCKWOOD, the contractor, to Mr. THOMAS L. LIVERMORE. Some say that the work will now be pushed; others claim that this is only a preliminary step in the transfer of the franchise to New York capitalists. The charter expires in 1891.

AN INTERNATIONAL EXHIBITION OF MINING AND METALLURGY is to be held in London in July—September, 1890, according to a tremendous prospectus which reaches us, headed by a long list of titled dummies and nobodies (with an occasional titled somebody), according to the rather offensively snobbish habit of our cousins over seas. As the guarantee fund amounts to only $13,000, all in small subscriptions of $5 to $500, and as there is a round charge for space ranging from $15 to $25 as a minimum, it is not likely that there will be much that is international about it but its name. These special exhibitions seem to be successful in London, however, and blank applications for space can be obtained from Barclay, MacGregor & Co., 35 Exchange Place, New York.

THE JAMAICA INTERNATIONAL EXHIBITION of 1891 is represented in New York by Mr. WM. LANE BOOKER, Her Britannic Majesty's Consul General at New York. This exhibition, as before noted, is to be opened on Jan. 1, 1891, under the auspices of the Government of Jamaica. A large space has been devoted to American exhibits, and the managers hope that the citizens of the United States will avail themselves of this opportunity to introduce their manufactures into Jamaica. All communications should be addressed to Mr. THOMAS AMOR, Secretary to the Committee, Stewart Building, New York City.

THE NEW CONGRESSIONAL LIBRARY, at Washington, D. C., is reported as being on a par with the Washington Aqueduct Tunnel, as far as bad work is concerned. Charges are made that the brickwork is very bad, much has been pulled down, and arches have fallen down; dangerous cracks have appeared; money is wasted, etc. The charges are made by a bricklayer once employed on the work, and may or may not be as bad as reported. It is said, however, that the cracks are there, giving color to his statements.

A SUB-COMMITTEEE OF THE PUBLIC LANDS COMMITTEE of the House of Representatives has been appointed to consider forestry legislation. Several measures of relative degree of merit will come before this committee, including Mr. DUNNELL's bill prepared by the American Forestry Association. This provides for the withdrawal of all government forest lands from sale and entry, and their temporary protection and management by a competent commission, who shall report a plan for permanent management at the next session.

LARGE ALUMINUM WORKS are proposed at Corry, Pa., a Chicago company being interested in them. It is proposed to use the electric process. Work will be begun in May, and the company is under bonds to expend at least $50,000 on its works the coming season.

THE COLORADO CANON EXPLORATORY SURVEY has been successfully completed, Chief Engineer STANTON and party having emerged uninjured at The Needles, Cal., after a most perilous but interesting trip. In all, 520 rapids were passed over, most of them slight, the most troublesome of all having been No. 465, where the plucky chief was sucked downward by a whirlpool and only escaped after an unpleasantly long submersion. The entire survey covered 900 miles of cañon, the last part the grandest of all, but all said to be entirely practicable for a railway, and that with easy curvature for the most part. Mr. STANTON and party are the only persons who have ever made this perilous trip, except Major POWELL, now of the U. S. Geological Survey, and his party.

RAILWAYS.

EAST OF CHICAGO. Existing Roads.

Lancaster & Hamden.—E. P. Buell & Co., the general contractors for this road, have let the contract for grading and bridging 50 miles of the line to G. H. Kyner, of Omaha, Neb. Carnegie Bros., of Pittsburg, Pa., have the contract for furnishing 7,000 tons of 65-lb. steel rails for the line. It is expected that tracklaying will begin about April 10.

Toronto Belt.—Manning & McDonald, of Toronto, Ont., have been awarded the contract for the construction of the belt line railway around the city of Toronto, for $148,000. The Grand Trunk Ry. will operate the line on a 40-years' lease.

Canada Atlantic.—The engineers making the preliminary surveys for the projected extension of this road from Ottawa to Parry Sound are finding no trouble in securing a good line.

Confluence & Oakland.—This road has been sold under a mortgage to Cowen & Cross, and others, of Baltimore, for $100,000. The road runs from Confluence, Pa., to Manor Lands, Md., 20½ miles, and it is announced that the purchasers will complete the line from Manor Lands to Oakland, Md.

Bellefonte & Buffalo Run.—It is announced that this road is to be extended from State College, Pa., into Stone Valley, a distance of about 12 miles.

Old Colony.—Surveys have been completed by this company for an extension of the Mattapan Branch to a connection with the Providence Division at a point between Clarendon Hill and Hazlewood, Mass. It is stated that construction will begin at once.

Cincinnati & Richmond.—Articles of incorporation for the consolidation of the Cincinnati & Richmond, Cincinnati, Richmond & Chicago, and Richmond & Miami railroads have been filed with the Secretary of State. The capital stock of the consolidated company is $1,250,000. The directors of the company are J. N. McCullough, Thomas D. Messler and James McCrea, of Pittsburg; and J. T. Brooks, of Salem, O.; James E. Neal, of Hamilton; D. S. Gray, of Columbus, and John F. Miller, of Richmond, Ind.

Wheeling & Lake Erie.—The contract for building the line from Martin's Ferry to Bellaire, O., 5 miles, has been let. The cost of the line will be about $452,000. Grading has been commenced on the line from Steubenville to Portland, O., a distance of 14 miles.

Baltimore & Ohio.—At a meeting of the stockholders recently held it was voted to lease the West Virginia & Pittsburg R. R. in West Virginia. This gives the B. & O. control of the valuable roads in West Virginia known as the Camden system. They cover the richest coalfields in that State, and also traverse rich and extensive timber lands, and are a valuable acquisition. There are three lines included in the system; one from Clarksburg to Fairmont, one from Clarksburg to Weston, and a road from Weston to Braxton Court House. The road from Clarksburg to Weston has been operated as a narrow gauge, but the work of increasing it to standard gauge is being pushed, and the change will be completed in a short time.

Pennsylvania.—It is stated that this company is preparing to build a branch from Nanticoke, Pa., via Avondale, to Plymouth, Pa. This portion of the line will be built at once. It is the intention of the company to ultimately continue the extension through Edwardsville, Kingston, and Wyoming to West Pittston, Pa.

Projects and Surveys.

Falls Creek.—Frank Morrison, of Falls Creek, Pa., General Superintendent, sends us the following concerning this recently completed Pennsylvania railway:

The company was incorporated July 16, 1889, and the surveys for the line completed the same month. The route is from Falls Creek, Pa., where connection is made with the Allegheny Valley, the Buffalo, Rochester & Pittsburg, and the Reynoldsville & Falls Creek railways to London Mines, in Jefferson County, a distance of 3 miles. The road was completed in January, 1890. It is essentially a coal road, penetrating the richest portion of the Reynoldsville coal basin. The officers of the company are: President, H. K. Wick, of Buffalo, N. Y.; Treasurer, W. D. Ward, of Buffalo, N.Y., and Secretary and General Superintendent, Frank Morrison, of Falls Creek, Pa.

Middletown & Cincinnati.—A press dispatch from Middletown, O., states that this company was chartered in Ohio several months ago to build a railway from Middletown east to the coal fields. The surveys for the line have just been completed, and estimates are now being prepared. It is stated that the work securing the right of way will be commenced at once, and the road constructed immediately. The officers of the company are: Paul J. Sorg, President; C. F. Gunckle, Vice-President; T. C. Simpson, Treasurer and General Manager, and M. D. Burk, Chief Engineer.

Grand Rapids, Chicago & St. Louis.—The Grand Rapids & Lake Michigan R. R. Co., which was chartered to build a line of railway from Grand Rapids, Mich., via Holland and South Haven to Benton Harbor, Mich., has been reorganized under the above name. The officers are: President, W. D. Tolford; Vice-President, C. E. Temple; Secretary, C. W. Garfield, and Treasurer, C. H. Hall.

Hocking & Western.—The survey for this Ohio road has been completed from London to Floodwood. President, H. B. Cramer, New York City; Vice-President, G. R. Carr, Columbus, O.

Bellaire & Valley Junction.—Chartered in Ohio to build a line of railway from Bellaire, O., via St. Clairsville, Cadiz, New Philadelphia, and Canal Dover to Valley Junction. It is not expected that this company will build the road, but will complete the preliminary work and put it in the hands of a company that will build it. The capital stock is $10,000, and this amount, it is calculated, will be sufficient to complete the necessary surveys, secure the right of way, etc.

Stanstead & Hereford.—A project is on foot to build a railway from Stanstead to Hereford, P. Q., and Canaan, Vt.

SOUTHERN.—Existing Roads.

Norfolk & Western.—Track is now laid to a point 67 miles west of Graham Junction on the Clinch Valley division of this road. The end of the track is 2 miles west of Cleveland and 7 miles east of Bickley's Mills. This latter place will probably be reached by April 10.

Birmingham, Sheffield & Tennessee.—This road has been completed from Jasper, Ala., south to a connection with the Georgia Pacific R. R., a distance of 9½ miles. It is thought that the line will soon be extended further to the coking coal fields of the Blue Creek and Pratt mines.

Tavares, Apopka & Gulf.—This Florida railway has been sold at foreclosure sale to Henry H. Jackson, of New York City, and Charles Tremaine, of Oswego, N. Y. About 30 miles of the road are now in operation and it is proposed to extend it to Oakland shortly.

Lynchburg & Durham.—Tracklaying is making good progress on this road, the line being completed to a point 12 miles south of South Boston, Va. As soon as the bridge is completed across the Hyco River at this point, track laying will be pushed as fast as possible, and the road completed to Durham, N. C.

Charleston, Cincinnati & Chicago.—Work is making satisfactory progress on the extension of this road. The road bed between Rutherfordton and Marion, N. C., has been graded, with the exception of about 3 miles, and tracklaying will soon begin. The line west of Johnson City, Tenn., is under construction for a distance of about 90 miles into the coal regions.

Cape Fear & Yadkin Valley.—Construction is now in progress on this road at three different points: from Milboro, N. C., down Deep River, to Ramsear, N. C., from Mt. Airy, N. C., to a granite quarry, and from Mt. Airy to the Virginia State line.

Cincinnati, Alabama & Atlanta.—A meeting of the stockholders of this company is to be held April 16, to elect officers. It is announced that the prospects for carrying out the enterprise are very good. The line is projected to run from Huntsville, Ala., to Somerset, Ky., a distance of 260 miles. The division from Tullahoma, Tenn., to Huntsville, Ala., will be built first. O. H. P. Cornell, of Tullahoma, Tenn., is Chief Engineer.

Chattanooga Southern.—Surveys will commence at once for the proposed extension of this road to Gadsden, Ala. It is expected to commence work at once and have the extension in operation by July 1.

Middle Georgia & Atlantic.—It is reported that this company have 109 miles of its line under contract. The road will run from Atlanta, Ga., via Covington, Machen, Eatonton and Sandersville, to Savannah, Ga., a distance of about 238 miles. The division between Machen and Eatonton, Ga., 16 miles, is nearly completed.

Nashville, Chattanooga & St. Louis.—It is stated that this company has under consideration the purchase of the Tennessee & Coosa River R. R., running from Atalla to Gadsden, Ala. If the road is purchased the intention is to extend the line from Atalla to Huntsville, Ala.

Georgia Southern & Florida.—A press dispatch states that track is being laid on the Macon & Birmingham R. R. at the rate of 1 mile per day.

Washington Southern.—The Alexandria & Washington R. R. Co., and the Alexandria & Fredericksburg Ry. Co. have been consolidated under the above name.

Lexington Belt.—Work is being rapidly pushed on the 8-mile belt line at Lexington, Ky., and it is expected to have the road completed and opened in a few weeks. Chas. H. Stall, of Lexington, is President.

Birmingham, Sheffield & Tennessee River.—Bids are asked for clearing, grading, and grubbing 16 miles of this road from Margerum, Ala., to the Tennessee River. A. Mitchell, Chief Engineer, Sheffield, Ala.

Projects and Surveys.

Yemassee & Walterboro.—A correspondent writes us that the right of way has been nearly all secured for this 40-mile North Carolina railway. Only the preliminary surveys have been completed as yet. The road will, it is expected, have a large business in phosphate, lumber, naval stores, cotton, and rice. R. C. Burkley, of Charleston, S. C., is President, and Gordon Gairdner, of Augusta, Ga., is Chief Engineer.

Florida, Dawson & Northern.—Surveys will commence soon for this road which is projected to run from Dawson, Ga., to Tallahassee, Fla., a distance of about 100 miles. R. L. Bennett, of Dawson, Ga., is President, B. H. Hood, Secretary and Treasurer, and F. A. Ruggles, General Manager.

Maryville & Montvale.—Efforts are being made by the people of Maryville, Tenn., to secure the construction of a railway from that place to Montvale, Tenn. About $60,000 have already been raised by the people along the route in aid of the enterprise, and it is expected that this amount can be considerably increased. The plan is to subscribe enough to do the grading on the road, and then donate the line to some company which will operate it.

Florida Improvement & Construction Co.—This company has engineers in the field surveying a line from Ku-Klux Ferry, on the Savannah River, in Georgia, to Jacksonville, Fla. Surveys have already been completed from Raleigh, N. C., to Ku-Klux Ferry. The object of the surveys is to obtain a short north and south line of railway from Jacksonville to New York.

Kentucky.—The following railway bills have been introduced into the Kentucky State Legislature: To incorporate the Cincinnati, Covington & Rosedale Ry. Co., the Waco & Richmond R. R. Co., the Altamo & Manchester R. R. Co., the Hartford & Fordsville R. R. Co., the Louisville, Covington & Cincinnati R. R. Co., the Pineville, Mt. Pleasant & Big Stone Gap R. R. Co., the Paducah, Nashville & Charleston R. R. Co., the Big Hill & Manchester R. R. Co., the Three Forks Belt Line R. R. Co., the West Point & Louisville R. R. Co., the Somerset and Eastern Kentucky R. R. Co., the Bowling Green and Southern R. R. Co., the Cumberland R. R. Co., the Lancaster, McRae & Middlesborough R. R. Co., the Danville, Lancaster & Pound Gap R. R. Co., the Owensboro & Madisonville R. R. Co., the Kentucky River & Virginia R. R. Co., the Fort Jefferson Belt R. R. Co., the Danville R. R. Co., the Anderson Hill Inclined Plane & Ry. Co., the Cumberland River & Jellico R. R. Co., the Kentucky & Southeastern Ry. Co., the Cincinnati & Kentucky R. R. Co., the Owensboro Belt Ry. Co., the Central Kentucky & Ohio River R. R. Co., the Paducah, Smithland & Southern R. R. Co., the Burkesville & Northwestern R. R. Co., the Carter County R. R. Co., and the Kinniconnick & Freestone R. R. Co.

Washington & Elberton.—At a meeting of the directors recently held it was voted to consult with the officers of the Richmond & Danville, and the Georgia, Carolina & Northern railway companies, in regard to this road. The company will grade the roadbed on condition that the other roads will complete and operate the line.

Georgia, Tennessee & Illinois.—L. F. Bellinger, of Tallapoosa, Ga., Chief Engineer, sends us the following concerning this enterprise:

The road is to run from Tallapoosa, Ga., to Chattanooga, Tenn., and is now under survey. The route is through a very mountainous country, and the work will be difficult. The principal business of the road will be timber, iron ore, and manufactures. Very little has been done toward securing the right of way and other local aid. The company was incorporated Nov. 13, 1889. W. B. Thomas, of Tenmile, Ga., is President.

West Virginia Central.—This company has been reorganized and the following officers elected: President and Treasurer, Alexander Boudrou; Vice-President, H. C. McWhorter, of Charlestown, W. Va., and Fred T. Clark, Secretary. The company was originally chartered in 1883, and under tais charter a line was surveyed from Ceredo, W. Va., on the Ohio River, directly east across West Virginia and Virginia to Belle Plain, Va., on the Potomac River, a distance of about 300 miles. About $2,000,000 was expended in these surveys and in grading 20 miles of the line. Since this time nothing has been done. It is now stated that the project will be carried through.

NORTHWEST.—Existing Roads.

Kearney & Black Hills.—Grading is reported in progress on this road from Kearney to Callaway, Neb., a distance of 65 miles. It is expected to have this division of the line completed by Aug. 15. The road will ultimately be extended to the Black Hills.

Chicago, Fort Madison & Des Moines.—This company has been chartered in Iowa to assume control of the Fort Madison & Northwestern Ry. It is announced that the road will be widened to standard gauge and extended to Ottumwa, Ia. The directors of the company are: Willard T. Block, E. S. Conway, Buren R. Sherman, A. E. Whitney, Wm. P. Scott, Frank A. Seymour, Sam Atlee, E. S. Skinner and Jas. A. Parmelee. Wm. P. Scott is General Manager.

Projects and Surveys.

Winnipeg & Southeastern.—A press dispatch quotes one of the directors of this company as saying that the road will be built and equipped this year, and that it will be used for transporting wood and timber until connection can be made with the line from Duluth, Minn., northwest.

St. Clair, Madison & St. Louis Belt.—Incorporated in Illinois to build a line of railway from Belleville, via Alton, Ill., to St. Louis, Mo. The incorporators are: H. M. Hill, F. M. Horner and Jno. McIntyre, of East St. Louis, and Geo. S. Drake and Alva Mansur, of St. Louis.

SOUTHWEST.—Existing Roads.

Houston, Central Arkansas & Northern.—Construction is being pushed rapidly forward on this road. Track has been laid to within a short distance of the Louisiana State line, 35 miles from Dermott, Ark. There remains but 18 miles more of track to be laid, and the grading is already completed. It is expected that the road will be completed and put in operation by May 1.

Kansas City, Wyandotte & Northwestern.—Newman Erb has been appointed receiver of this road, on an application made by the Farmers' Loan & Trust Co., of New York City.

Projects and Surveys.

Corpus Christi & Brownsville.—It is stated that the arrangements are nearly completed for the construction of this road, which is projected to run from Corpus Christi to Brownsville, Tex., a distance of 50 miles.

Savannah & Tarkio.—A press dispatch states that a company has been organized to build a railway from Savannah to Tarkio, Mo., a distance of 40 miles. The people along the route are in favor of this enterprise, and will, it is stated, subscribe heavily for the stock.

Houston Belt & Magnolia Park.—A press dispatch from Houston, Tex., states that construction will soon commence on this road and the work pushed to completion as soon as possible. All the ties and other lumber are on hand, and the rails are on the way from New York. The road will be about five miles long, standard gauge, and laid with 56-lb. rails.

ROCKY MT. AND PACIFIC.—Existing Roads.

Canadian Pacific. The branch from Mission Station south to the International boundary has been completed for a distance of 15 miles. All but one of the bridges have been completed, and the remaining 12 miles of track will be completed in a short time. This branch will connect with the northern branch of the Seattle, Lake Shore & Eastern R. R., now under construction.

Carson & Colorado.—It is rumored that this company will build an extension from Keeler, Cal., south about 50 miles during the present season.

Atchison, Topeka & Santa Fe.—Surveys are now in progress for a branch from Artiz Station to San Pedro, N. Mex.

Union Pacific.—Vice-President Holcomb, of this company, is quoted as saying that the contract for completing the Cheyenne & Northern extension, to a connection with the Fremont, Elkhorn & Missouri Valley R. R. has been let to Kilpatrick Bros. & Collins, and that work will be commenced at once. The route of the line has been located, and the grade stakes driven. It is expected that the line will be completed by July 1. The extension is 21 miles long.

Projects and Surveys.

Montana & Canada.—The route of this road has been located. The line will run from Great Falls, Mont., up the Run River valley, and in a general northwest direction to Leithbridge, N. W. T. It is stated that construction will commence at once.

Okanagon & Kootenai.—Organized in British Columbia to build a railway from Sproat's Landing to Vernon. Edward A. Prior, of Victoria, B. C., is one of the incorporators.

Drayton Harbor, Lynden & Spokane Falls.—Incorporated in Washington to build a railway from a point on Drayton Harbor east through Whatcom County.

Portland, Port Angeles & Victoria.—This company has been incorporated in Oregon to build lines of railway from Port Angeles to Gray's Harbor, Wash., from Gray's Harbor to Portland, Ore., from a point in Chehalis County to Olympia, Wash., and from Gray's Harbor to a point on the Columbia River, opposite Astoria, Ore. In addition, the company is empowered to facilitate the construction of any railroad or steamship line running out of Port Angeles, to run steamships between Port Angeles, Victoria, Portland, Sitka, San Francisco, Gray's Harbor or other Pacific Coast points, and do a general railroad business. The incorporators are: Charles J. Smith, Edward Cookingham, and Donald Macleay, of Portland, Lewis Levy, E. B. Mastick, Jr., and W. R. Gay, of Port Angeles, and A. C. Martin, of Seattle. The capital stock of the company is $3,000,000, and its principal office is in Port Angeles.

Wyoming, Salt Lake & California.—It is announced that this company has been reorganized and the money necessary to build the line secured. J. W. Moffatt, of Salt Lake City, Utah, is Chief Engineer.

Shuswap & Okanogan.—A bill has passed the Provincial Legislature granting aid to this company, which propoposes to construct a railway from a point on the main line of the Canadian Pacific R. R., near Sicamous Narrows, up the Shuswap River to a point on Okanogan Lake.

Glen Ellen & Los Guillicos.—This company has been chartered to build a railway from Glen Ellen to Los Guillicos, Cal., a distance of 34 miles. Among the incorporators are, A. P. Overton, N. W. Griswald and W. H. H. Graves.

Seattle Terminal Railway & Elevator Co.—This company has been organized at Seattle, Wash., to build warehouses and a short line of railway at that place.

FOREIGN.

Mexican Pacific.—The *Mexican Financier* contains the following concerning this enterprise:

From the Port of Tonalá, on the Pacific coast, the road is under contract to the Port of Frontera, on the Gulf of Mexico, and construction is going on actively from Tonalá, across the State of Chiapas. The railroad will pass through two extensive coal fields, one of which is situated in Tabasco and will supply steamers in the Gulf of Mexico; the other is in Chiapas, favorably situated for supplying steamers on the Pacific Ocean. The road, for over 150 miles, will pass through immense forests of mahogony and

dye-woods, hitherto untouched for lack of facilities for transport. The rest of the route passes through a rich agricultural, well-settled country, excepting where it crosses the Sierra Madre range of mountains, which in this part are heavily timbered with pitch pine of excellent quality. In the District of Tonalá the railroad passes immediately at the foot of two large iron mountains, consisting of almost solid masses of iron ore carrying from 60 to 64 per cent. of metallic iron, and sufficiently free from sulphur and phosphorus as to be fit for the manufacture of steel rails. The quantity of iron ore in these two hills, above the level of the surrounding country, and as miners say, "in sight," is estimated at 200,000,000 tons, and may be termed inexhaustible. At the port of Tonalá, the railroad company has erected a substantial pier 1,075 ft. long, completely equipped with double track railway, steam cranes, etc., capable of handling weights up to 20 tons. Another line of railroad has been projected, surveyed, and is now being contracted for to extend along the whole Pacific Coast of the State of Chiapas, and is intended to form a link in the railway connection from the City of Mexico to the Isthmus of Panama, by way of Central America. In connection with this railway a pier will be erected at the Port of San Benito, in the Province of Soconusco, in the State of Chiapas. The lands on the Pacific coast of Chiapas are noted for their fertility. They are well watered by permanent streams from the mountains, and once afforded railroad facilities for moving their products, the development of this part of the State of Chiapas must be rapid. A vessel leaves Newport, England, every month with over 2,400 tons of rails and accessories, telegraph materials, rolling stock of one kind or another.

Ixtacalco.—The railway to Mexicaltzingo is expected to be completed and opened for traffic April 2. The section to Ixtapalpa will be finished about May 15.

Mexican Central.—A press dispatch from El Paso, Tex., says: The last tie on the Agnar Caliente and Tampico branch of the Mexican Central Railway will be laid March 29. The last spike will be driven and the first experimental train run through from San Luis Potosi to Tampico, on the Gulf of Mexico. The formal celebration of the opening of the new short line between El Paso and the Gulf coast will not take place, however, until April 10, when it will be celebrated in an imposing manner at Tampico.

Guatemala.—A press dispatch from the City of Mexico reads as follows: A contract has been made between the Government of Guatemala and Henry L. F. Cottu, the representative of a French syndicate, for the construction of the Northern Railroad of Guatemala, extending from the capital to the Atlantic Ocean. This line will connect with the Central Railway, running between the capital and the Pacific Ocean, and will thus complete the interoceanic route across the Republic. The French company will place at the disposal of the Government $21,312,500 in gold. With this money the nation will purchase the Guatemala Central Railroad, valued at $5,000,000 in Guatemala coin, and with the remainder the company will construct the Northern Railroad, with the necessary wharves at the seaports, stations, etc. Ten millions of francs will be employed in establishing an Agricultural Mortgage Bank. As a guarantee of the payment of the principal and interest of this loan the French company will receive a mortgage on the tax on spirituous liquors. The Government will control and manage the railroad and banking institutions as National property, the National treasury profiting by the gains or bearing the losses.

Sonora, Sinaloa & Chihuahua.—It is announced that construction will be resumed on this road at an early date. The road is projected to run from Guyamas, N. Mex., to Chihuahua and Guyamas, Mex. About 40 miles of the line have been graded from Deming south, and track will be laid on this portion at once.

RAPID TRANSIT.

Street Railways.—The Union St. Ry. Co., of Brooklyn, N. Y., has been incorporated by Henry R. Hoyt and Lewis H. Lapham, of New York; Cornelius E. Donnellon and Reuben Leland, of Brooklyn. Capital stock, $100,000. The line will be 2 miles long on Union St.

The Post Office & Schenley Park Passenger Ry. Co., of Pittsburg, Pa., will extend its lines. President, W. G. McCandless; Secretary, J. W. Breen.

The street railway system at Lansing, Mich., has been sold to W. M. Lamphere and M. D. Skinner, of Des Moines, Ia., and H. L. Hollister, of Sioux Falls, No. Dak.

The West End St. Ry. Co., of Rockford, Ill., has been incorporated by J. S. Ticknor, B. A. Knight and Otto W. Haegg. Capital stock, $30,000.

Cable Railways.—Work on the Druid Hill Park extension of the People's Line Ry., at Baltimore, Md., has been commenced by E. D. Smith & Son, the contractors. The cost is estimated at $70,000 to $80,000 per mile.

Electric Railways.—A franchise for an electric street railway has been granted at Greenfield, Mass.

The electric railway between East New York and Jamaica, N. Y., is to be improved and extended. Mr. Spencer, of Drexel & Morgan, is President.

The Rochester St. Ry. Co., of Rochester, N. Y., has decided to adopt the Short electric system. The contract calls for 200 motors of 15 H. P. each, and a sufficient number of generators to produce 1,100 H. P. The cars will be 16 ft. long, and of the vestibule pattern. The track will be relaid with steel girder rails.

At East St. Louis, Ill., an electric railway is to be built on Broadway by McCasland & Guignon.

The Central City Electric Ry. Co., of Peoria, Ill., will extend its line on Knoxville St. and to Reservoir Park.

The Duluth Electric St. Ry. Co., of Duluth, Minn., has been organized by J. R. Myers, H. H. Myers, and B. F. Myers. Storage battery cars are to be used on Superior St. and the Thomson-Houston or Sprague overhead wire system on 1st St.

The old electric railway at Los Angeles, Cal., has been purchased by a company organized at Topeka, Kan., and a contract has been awarded to the Sprague Electric Co for the equipment and refitting of the road.

HIGHWAYS.

Oregon.—Work will soon be recommenced on the Long Creek wagon road, the commissioners at Pendleton having taken the matter in charge. A mile of rock work on the North Fork and Camas Creek divisions yet remains to be completed.

Massachusetts.—At Bradford, Mass., an appropriation of $35,000 has been made for highways.

Rhode Island.—The House Highway Committee held a public hearing last week at Providence. W. M. P. Bowen, for the Rhode Island State Roads Improvement Association, suggested that the law for a change to a single surveyor and cash taxes be submitted to each town for acceptance, so as to allow full liberty. David S. Collins, Secretary State Board of Agriculture, suggested the appointment of a State Commissioner of Highways, or State Engineer, with an office in Providence, he to have a secretary, to see that all State laws be enforced relating to highways, to consult with all town Commissioners of Highways in different towns free, to keep all records of improvements, to supply free of charge plans to town commissioners and to establish a grade for all roads in the State. Representative Frank W. Tillinghast, of Johnston thought no one could speak too strongly of the bad state of Rhode Island roads, and they had not grown any better during the last two or three years, although probably the wet season had produced worse results than otherwise would have been. There was a provision in the statutes by which a town can be indicted and punished for having roads impassable and poor, and there were many towns that could not now escape indictment under that law. Mr. Coombs, of Cranston, said that in Cranston they had material of the best kind for the building of roads, from the gravel pits. With a good steam roller they could build as good a road as was to be found in any part of the country. The difficulty was to get the road hard enough to stand the tear of the stone teams from the quarries, which would form a rut, stick to it and cut it deeper. This, however, had not occurred where the steam roller had been used.

Ohio.—The citizens of Mt. Pleasant have petitioned the town council to issue long termed bonds for the purpose of constructing a turnpike from that place to Mt. Pleasant station on the Wheeling & Lake Erie R. R., a distance of 1½ miles. The cost is estimated at from $5,000 to $7,000. The citizens have just finished paying a 5 per cent. tax for the construction of the Adena and Glens Run turnpike.

West Virginia.—The following proposals have been received at Moundsville, for macadamizing and road work. The contract has been awarded to Walter Dugan.

Bidders.	Bed rock delivered per cu. yd.	Macadamizing first mile, per cu. yd.	Macadamizing second mile, per cu. yd.	Macadamizing third mile, per cu. yd.	Macadamizing fourth mile, per cu. yd.	Ditching, grading and surfacing fifth mile and last half mile.
Lawrence Clark & Co., Wheeling, W. Va.	$0.95	$1.55	$1.50	$1.37	$1.60	.....
Harry Hayden, Elm Grove, W. Va.	....	....	2.25	2.28	2.30	$1,480
Andrew Hammond, Powhattan, O.	1.00	1.85	1.85	1.85	1.85	275
John Lanahan, Wheeling, W. Va.	1.00	1.35	1.40	1.45	1.50	1,500
Frank Higgs, Wheeling, W. Va.	....	2.30	2.23	2.36	2.20	1,570
A. W. McDonald, Pittsburg, Pa.	1.05	1.69	1.63	1.61	1.55	520
J. Anderson, Elm Grove, W. Va.	1.75	2.28	2.30	2.35	2.25	1,760
W. Wickham, Tridelphia, W. Va.	1.50	1.59	1.81	1.95	2.25	.....
David Nickerson, Wheeling, W. Va.	1.77	2.30	2.25	2.29	2.35	.....
T. B. Post & Co.	....	....	....	1.85	1.75	430
Walter Dugan, Benwood, W. Va.	0.79	1.78	1.75	1.30	1.30	260

WATER-WORKS.

NEW ENGLAND.

Cape Elizabeth, Me.—It is reported that all the difficulties in regard to the introduction of Sebago water into the town this season have been adjusted, that the contract will be signed at once, and that operations will soon be commenced. [For details of the plan to be adopted see ENGINEERING NEWS, March 15, page 261.—ED.]

Rochester, N. H.—The following is taken from the Boston *Journal:*

Rochester has appointed and empowered a committee to construct water-works for its three villages, or purchase those already built.

Cottage City, Mass.—Extensions are to be made. Pipe-laying will soon be commenced.

Brookline, Mass.—We have received the following from F. F. Forbes, Superintendent:

About 3 miles of 24 to 6-in. pipe will be laid this season and about 20 hydrants, 20 valves, and 150 meters, will be set.

Worcester, Mass.—The City Council has passed an ordinance authorizing the issue of $30,000 of 30-year 4 per cent. water bonds.

MIDDLE.

Highland Falls, N. Y.—We have received the following information from J. F. Stephens:

There are no water-works in this place at present, but I expect that a system will be established this summer. Population, 2,500. Nothing definite has yet been done.

New York, N. Y.—A bill has been introduced by Senator Stewart providing for the establishment of a large number of additional hydrants of an improved pattern. The bill provides that the power of locating additional hydrants shall be vested in the Board of Fire Commissioners, and the work executed under their direction by the Department of Public Works.

Gloversville, N. Y.—Reports state that the water supply has been rendered unfit for use by contamination with with the sewerage system.

Glens Falls, N. Y.—A bill has been introduced into the Legislature asking for the passage of an act authorizing the board to issue bonds to the amount of $45,000 to lay new water mains; $5,000 payable annually. E. R. Safford is Clerk of the Board of Trustees.

Lockport, N. Y.—Excavation is now going on at the pumping station for the new pump, to have a capacity of 5,000,000 galls. per day. It will be attached to the old water wheel. The pump will be furnished by the Holley Mfg. Co., of Lockport, N. Y.

Geneseo, N. Y.—Samuel H. Blythe, Secretary and Superintendent, informs us that about 1 mile of new pipe, 6 and 8 ins. in diameter, will be laid, and that 7 hydrants and 8 valves will be set, this season. These extensions are made to convey a water supply to the County House.

Pittsburg, Pa.—J. P. Bingamon, Secretary of the Department of Awards, informs us that the following bids have been received for furnishing cast-iron water pipe:

	12-in. B. 25 tons.	16-in. C. 47 tons.	24-in. B. 930 tons.	24-in. C. 432 tons.	30-in. B. 817 tons.	Special Castings. 60 tons.
Mellert Foundry & Machine Co., Ltd., Reading, Pa	$25.20	$25.20	$25.20	$25.20	$25.20	$50.00
National Foundry & Pipe Works, Scottdale, Pa	23.40	23.40	23.40	23.40	.....	.....
Dennis Long & Co., Louisville, Ky.	23.00	23.00	23.00	23.00	23.00	44.00
Addyston Pipe & Steel Co., Newport, Ky.	23.55	23.55	23.55	23.55	23.55	50.00
Wm. Yagle & Co., Ltd.	.....	.....	.....	Special Castings	12-in. & 16-in. 24-in. & 30-in.	49.00 55.00

The contract was awarded to Dennis Long & Co., of Louisville, Ky.

Oakland, Md.—Water bonds for $10,000 will be issued.

SOUTHERN.

Richmond, Va.—Superintendent Charles E. Bolling informs us that contracts for the supplies needed this year have been awarded as follows:

Tredegar Co., 4-in. pipe, $33.50 per ton of 2,240 lbs; 6-in., $32.50 per ton of 2,240 lbs.; special castings, 2¼ cts. per lb., delivered. Burton & McGhee, large and small boxes, 2 cts. per lb. Chapman Valve Mfg. Co., Indian Orchard, Mass., (through West & Branch, agents); hydrants, $21.93 each. The Eddy Valve Co., of Waterford, N. Y. (through the Southern Railway Supply Co., agents), 4-in., $8.07; 6-in., $13.37; 8-in., $20; 12-in., $30; 16-in., $67.50.

Albany, Ga.—Another vote has been taken upon the question of issuing water bonds.

Shelby, Ala.—Address the Shelby Iron Co. for information regarding the projected works.

Crystal Springs, Miss.—Estimates for constructing a small system of works are wanted by H. C. Price.

New Orleans, La.—A price has been agreed upon between William W. Deutsch, President of the National Water Purifying Co., of New York, and the water company, for a filtering plant having a daily capacity of 1,500,000 galls., and the contract will be completed as soon as pending legal controversies between the city and the water company are adjusted.

Columbia, Tenn.—The opposition to having water pipes, etc., extended to the suburb, West End, has been withdrawn, and the extension of water mains will now be made.

Franklin, Tenn.—Northern capitalists have made a proposition to the town to establish works.

Cleveland, Tenn.—A vote will probably be taken on the question of constructing works.

Morristown, Tenn.—J. J. French and T. V. French are interested in (probably contractors for) a plan to introduce a water supply.

Rockwood, Tenn.—It is reported that the Cardiff Coal & Iron Co. is to build a new town, and that it contemplates building works to cost $75,000.

Fayetteville, Tenn.—Secretary H. K. Bryson has kindly sent us the following information:

A 20 years' franchise has been granted by the city to the Fayetteville Water-Works Co. for constructing a system of works. The town will rent 30 hydrants at $50 each per year.

About 4½ miles of 10 to 4-in. pipe will be used. Two pumps, each of 1,000,000 galls. capacity per 24 hours will be required, and two boilers of sufficient capacity to run the pumps. Valves are to be so placed as to cut off not more than ¼ of a mile of pipe for repairs. A new 1,000,000-gall. reservoir is to be built at such a height as to enable four streams from four different hydrants to be thrown 80 ft. high in the business portion of the town.

Two sources of supply are open, Elk River, 1¼ miles south of the reservoir site, and springs, on Pea Ridge, five miles south of the river. The latter would be a gravity supply. The reservoir site is about 150 ft. above the business portion of town, 210 ft. above the river, and about 30 ft. below the springs on Pea Ridge. The franchise provides for a substantial pump-house, and that rates for water shall not exceed those charged in Chattanooga in 1889.

Louisville, Ky.—A stand-pipe was destroyed, and a large amount of damage was done to mains, and to the system in general, by the recent cyclone. A new stand-pipe is being erected, and a large amount of other improvements will be made as rapidly as possible.

NORTH CENTRAL.

Eaton, O.—The bill authorizing the town to issue bonds for establishing works has passed the Senate.

Oberlin, O.—Improvements costing $10,000 are projected. A bill is before the Legislature, asking for authority to issue bonds for that amount.

Cleveland, O.—All the bids received on March 26 for furnishing valves, as specified, have been rejected, and proposals for furnishing and delivering 9, 36, and 13 16-in., geared screw hub water valves, and 1 36-in. check-valve, with 4-in. by-pass, the 36-in. screw-valves to be geared to work horizontally, will be received until April 14. All to be tested under a hydrostatic pressure of 300 lbs. per sq. in. Separate proposals will be received for single stem and double stem 36-in. valves. Also, for the check-valve, and for the 36-in. and 16-in. screw valves. Address the Trustees of Water-Works.

R. D. Wood & Co., of Philadelphia, Pa., have been awarded the contract for furnishing the fire hydrants to be set during this year.

Bond Hill, O.—The bill recently introduced into the Legislature to authorize the town to issue $20,000 of water bonds has passed the Senate.

Coshocton, O.—The vote on the question of issuing bonds for building works will be taken on April 7.

Coldwater, Mich.—The Common Council has agreed to submit, at the coming election, the proposition to issue $70,000 of 4 per cent. bonds to put in works.

St. Josephs, Mich.—It is reported that a system of water supply will be furnished to the town from the lake.

Chicago, Ill.—A new pumping station is to be established at Bridgeport locks. New pumping machinery will be purchased. The Board of Aldermen have appropriated $150,000 for carrying out this work.—The Pacific Water Co. has been incorporated to acquire water rights, etc. Capital, $1,000,000. The incorporators are: A. A. Goodrich, C. L. B. Withrow and W. N. Sturgin.

Peoria, Ill.—Instead of constructing two reservoirs of 7,500,000 galls. capacity, respectively, the company proposes to build one reservoir of 18,000,000 to 20,000,000 galls. capacity; also to put up larger pumps and to put in six steel boilers instead of ten, as called for in the original contract with the city.

Milwaukee, Wis.—City Engineer George Benzenberg, in a report recently submitted to the City Council, recommends that a tunnel, 7½ ft. in diameter, be constructed for a distance of 3,000 ft. from the land shaft to an intermediate crib, instead of two lines of pipe, as previously recommended. From this crib two lines of pipe, each 5,000 ft. long, are to be laid, in about 60 ft. of water. The estimated cost of the first plan was $500,000. Mr. Benzenberg states that his plan can be prosecuted in less time, and that it will cost but $450,000.

NORTHWESTERN.

Leeds, Ia.—(A suburb of, and post-office is at, Sioux City, Ia.)—The Leeds Water-Works Co. will soon file articles of incorporation. It is the company's intention to establish a plant this season.

Des Moines, Ia.—Swan & Barrett, of Portland, Me., are now offering $100,000 of 6 per cent. bonds for sale.

Zearing, Ia.—Works are to be established.

Minneapolis, Minn.—The second of the Worthington pumps at the North Side station has been satisfactorily tested.

Mellette, So. Dak.—We have received the following:

The artesian well from which the supply will be drawn has been completed. Pipe will be laid during April. The Chairman of the Town Board can furnish information. Money is secured by town bonds.

Hardington, Neb.—Works are being constructed.

Omaha, Neb.—The American Water-Works Co. will submit the following proposition to the City Council:

That the City Council shall submit to the people the question of extending the time at which the city shall have the option of purchasing the water-works plant to 25 years from date. Under the present contract and charter this date falls in 13 years. If the voters declare in favor of granting the extension the company will put in 400 additional hydrants, making 1,500 in all, at a yearly rental that will not exceed the amount now being paid for the 1,100 hydrants already in use. The average price now paid for hydrants is $80 per year. Under the proposed arrangement the cost, with 400 hydrants added, would be reduced to $53 each per year. As the city grows and the number of hydrants is increased it is proposed to further reduce the cost so that when there are 3,000 hydrants in use the average cost of each per year will be but $30, or $90,000 for 3,000 hydrants, or $10,000 in excess of what is now being paid for 1,100 hydrants.

Jamestown, No. Dak.—An artesian well is to be bored to furnish the city with water.

Whitewood, So. Dak.—It is reported that new works will be put in operation about July 1.

Laramie, Wyoming.—The Union Pacific R. R. Co. has offered to turn the works over to the city, provided the city will keep them in repair, and furnish the company with free water.

SOUTHWESTERN.

Carrollton, Mo.—Consulting Engineer, W. Kiersted, of Kansas City, Mo., has kindly sent us the following information:

The Carrollton Water Co. has recently increased its capital stock from $30,000 to $50,000. Work on extensions is now in progress. A new stand-pipe, 10 ft. in diameter by 110 ft. high, is being erected, and several miles of new mains will be laid this season.

St. Louis, Mo.—Bids will soon be wanted by the Board of Public Works for two pumping engines, each having a daily capacity of 20,000,000 galls. M. L. Holman, Water Commissioner, has sent us the following:

About 15 miles of new pipe, 1 mile of 20-in., 4 miles of 12-in., and 10 miles of 6-in. cast-iron pipe, will be laid, about 150 new hydrants, and about 300 new valves and a number of meters will be set, this season. Work is now in progress on the low service conduit system.

Belton, Tex.—It is reported that bids are wanted for a five years' lease of the existing works. The present contract expires on July 13.

Houston, Tex.—Another well is being put down.

Hubbard City, Tex.—We have received the following information from S. H. Sayer, publisher of the Hubbard City *News:*

Contracts will be let in about 30 days. Work is to be commenced on May 1, and completed by Sept. 1. The plant will be put in by the Hubbard City Artesian Well & Water-Works Co. The directors are: H. G. Asken and H. H. Rowland, of Tyler, Tex.; T. C. Morgan, H. B. Allen and others, of Hubbard City. Estimated cost, $10,000 to $15,000; all subscribed by private citizens. Engineer in charge of surveys, Col. B. E. Wells. Population, 1,200.

Martin, Tex.—We have received the following:

Thomas & Gorman, of Houston, Tex., are the contractors for the new works, and will lease and operate them upon completion, in connection with the ice plant and electric light works.

Franklin, Tex.—New works are to be established. Preparations are now being made to commence pipe-laying. Hydrants will be used.

Littleton, Col.—The Citizens' Water Co., of Denver, will run two or more of their mains through, and supply the town with water.

Akron, Col.—The city's supply will be taken from a well, 14 ft. in diameter.

Denver, Col.—The American Water-Works Co., of Omaha, Neb., are pushing the work on their contract with the Denver Water Co. as rapidly as possible. The work is in charge of Edward Ruger, Engineer of the company.—A franchise has been granted to the Mountain Water Co. to lay pipes in several streets west of the Boulevard and south of the Golden road by the County Commissioners.

PACIFIC.

Seattle, Wash.—Mr. Durie's report to the City Council, for the Fire and Water Committee, asking for an appropriation of $775,000, has been adopted. The details of his estimate are as follows: distribution system, $325,000; five new pumps and supply mains, $100,000; purchasing the Spring Hill Co.'s plant, $350,000.

East Portland, Ore.—The East Side Water Co. has been incorporated by Cyrus Buckman, C. H. Rafferty and H. C. Myers, to construct, maintain and operate a system of works. Capital stock, $120,000, divided into 2,400 shares of $50 each.

Portland, Ore.—The Holly Mfg. Co., of Lockport, N. Y., has shipped the additional new pump by a special train. The weight of the cargo was 250 tons.

Los Angeles, Cal.—The mayor has signed the ordinances granting a water franchise to Major E. L. Stern, Mr. Stern's plan is to bring water to the city from a cañon of the Sierra Madres.

Paso Robles, Cal.—The new works have been completed.

San Bernardino, Cal.—The city has let a contract for boring two artesian wells.

Ketchum, Idaho.—The Puget Sound Pipe Co., of Olympia, Wash., has been awarded the contract for constructing the new gravity system of works. There will be 3 miles of mains, and 7 hydrants. Estimated cost, $12,000. The plant will be owned and operated by the Ketchum Spring Water Supply Co. President, George Steward; Secretary and Superintendent, George M. Snow; Treasurer, William H. Greenhow.

CANADA.

Toronto, Ont.—Sealed tenders addressed to William J. Hill, Chairman Committee on Water-Works, will be received until April 21 for furnishing the following materials:

4, 6 and 12-in. cast-iron pipe; special castings; 3, 4, 6 and 12-in. valves; pipe laying, hydrants, pig lead, lead pipe, bar iron and steel, brass work, etc.

Specifications and forms of tender may be obtained on application.

PROJECTS.

Mattapoiset, Mass.; Noah Hammond.——Marion, N. C. ——Jasper, Fla.——Sylacauga, Ala.——Fort Payne, Ala. ——Somerset, Ky.——South Amboy, N. J.; F. E. Degraw, Mayor.——Boeneton, N. J.; E. G. Meyers, Mayor.——Newton, N. J.——Lake Linden, Mich.——Seneca, Kan.——Monroe City, Mo.; Geo. W. Tompkins, City Clerk.——Brunswick, Mo.; L. Benecke.——Stuttgart, Ark.——Heppner, Ore.

FOREIGN.

Nagasaki, Japan.—The water-works now being constructed will be completed in April, 1891. The estimated cost is $300,000.

IRRIGATION.

Livingston, Mont.—An irrigation system will probably be constructed in Paradise Valley by W. F. Kirkby. It is proposed to take water out of the Yellowstone River, at a point near Chickery, thence along the west side of the river through Paradise Valley. The length of the ditch will be about 10 miles. The ditch will have a capacity of 2,500 in., and will cost between $7,000 and $10,000.

Roswell, N. M.—The First New Mexico Reservoir & Irrigation Co. has been incorporated by S. H. Jaffa, of Trinidad, Col; G. E. Overton, of Fort Stanton, N. M.; W. S. Prager and L. M. Long, of Roswell, and John J. Cockrell, of Lincoln, N. M. Capital stock, $400,000.

Delta, Col.—Matt. Arch, of Gunnison, Col., has been awarded the contract for constructing the Black Cañon irrigating canal. It will be supplied from the Gunnison River. J. A. Curtis, the engineer in charge, has completed the surveys. About 8,000 acres of land will be reclaimed.

Denver, Col.—The Arnett ditch, which has its headgate at Morrison, is being enlarged to the capacity of about 175 cu. ft., with a width at the bottom of 9 ft., and 3 ft. in depth. The contracts were let to W. C. Henry and G. W. Harriman. Work is now nearly completed. Seventy reservoirs have been constructed along the line of the ditch.

SEWERAGE AND MUNICIPAL.

Sewerage.—At Pittsfield, Mass., the committee appointed by the fire district last year to make plans for a new sewerage will apply to the town at the annual meeting to take the matter off its hands. The town will be asked to appoint a committee to push the petition now before the Legislature regarding the issuing of bonds by the town, and later by the city, to cover the expenditure for sewers.

Bonds for $96,000 are to be issued at Elmira, N. Y., for carrying out work, the plans for which have been prepared by A. P. Bovier, City Engineer.

The New York State Board of Health has approved the plans proposed for sewerage at White Plains. Plans for sewerage at Holly are under consideration. A siphon system is to be adopted for White Plains.

At Baltimore, Md., City Commissioner Smyrk and his assistants are pushing forward as rapidly as possible toward completion the sewers ordered to be constructed under the provisions of the five-million loan. When all are completed Baltimore will be well provided with means for carrying off the storm water, which is all that these sewers are expected to do. The work of construction is under the supervision of Charles P. Kahler, Assistant City Commissioner.

A vote will be taken April 8, at Parkersburg, W. Va., on the issue of sewer bonds for $10,000.

Estimates are being prepared for a system of sewers at Columbus, Ga. C. J. Barney is Superintendent of Public Works.

At Atlanta, Ga., a vote will be taken April 25, on the proposition to issue $100,000 in bonds for sewer purposes.

The City Council of Salt Lake City, Utah, has passed an ordinance regulating the use of the sewers, prescribing the necessary plumbing, etc. The separate system is used, the sewers being separate from the storm water drains.

Street Work.—At Chattanooga, Tenn., it has been voted to issue $500,000 of 30 year 5 per cent. corporation bonds for the improvement of the streets.

At Rock Island, Ill., a large contract for brick paving has been awarded to the Rockford Construction Co., of Rockford, Ill.

A bill has passed the Ohio Senate authorizing Troy, O., to issue bonds for street extension and improvements.

The city engineer of Topeka, Kan., has been instructed to prepare specifications and estimates of the comparative cost of paving Topeka Ave. and other streets with vitrified brick, red cedar blocks, native blue limestone Colorado sandstone and asphalt.

Street Sprinkling.—The Peoria Street Sprinkling Co. of Peoria, Ill., has been incorporated by T. J. Quinn, Chas. J. Mulcahy, and Thos. N. Gorman. Capital stock, $5,000. The company has purchased some improved sprinkling machines.

At St. Paul, Minn., contracts for street sprinkling in certain districts have been awarded as follows by the

Board of Public Works: James Forrestal, 29, 29¼ and 29¾ cts. per week per 100 ft.; Patrick Norris, 28¼ cts.; Thomas Reilly, 28¼ cts.; Arthur Stevens, Jr., 31½ and 37 cts. per week per 100 ft., and 4 cts. per 100 ft. overhaul per week.

Ohio.—A bill has passed the State Legislature authorizing Ironton and Upper Township, Lawrence County, to issue $10,000 of bonds to construct a bridge.

Columbus, O.—Bids will be received until April 30, for the construction of a bridge over the Olentangy River, at

Sidewalks.—The following proposals have been received by the Board of Public Works, St. Paul, Minn., for constructing, relaying and repairing cement block sidewalks from April 1 to Nov. 1, 1890. The contract was awarded to James Forrestal.

Bidders.	Cement Block Walk, Hexagonal, Per Sq. Ft.	Cement Block Walk, Square, Per Sq. Ft.	Grnite Curb Stone, Per Lin. Ft.	Granite Curb Stone, Corners, Per Lin. Ft.	Resetting Curb, Including repairing Pavement where Disturbed, Per Lin. Ft.	Rubble Masonry, Laid in Cement, Per Cu. Yd.	Dry Rubble Masonry, Per Cu. Yd.	Brick Work, Per 1,000 Brick.	Earthwork, Per Cu. Yd.	Rock Excavation, Per Cu Yd.	Railway Iron, Per lb.	Wrought Iron, Per lb.	Concrete Under Crossing, and Elsewhere, Per Cu. Yd.	Pine Block Paving (Driveways) Per Sq. Yd.	Relaying Cement Block Walk, Per. Sq. Ft.	Cutting Cement Block Walk, Per Lin. Ft.	Totals
James Forrestal	$0.18¾	$0.19¼	$0.85	$1.00	$0.10	$1.00	$1.00	$10.00	$0.24	$0.30	$0.01	$0.06	$0.80	$1.30	$0.10	$0.08	$19,032 50
A. Anderson	0.18½	0.18½	1.10	1.50	0.10	3.40	2.50	11.80	0.28	0.50	0.01¼	0.04	3.00	1.20	0.07	0.05	19,575 50
Portland Stone Co.	0.19¾	0.19¾	0.75	1.50	0.20	3.50	2.00	10.00	0.35	1.00	0.02	0.04½	4.00	1.50	0.12	0.10	20,937 50
Theo. L. Morgan	0.18¾	0.18¾	1.00	2.00	0.10	3.25	3.00	12.00	0.25	0.80	0.01	0.06	3.50	1.30	0.08	0.01	20,007 50
Carl H. Park	0.19	0.19½	1.00	1.50	0 10	3.50	3.00	16.00	0 40	1.00	0.02	0.06	4.00	1.50	0.10	0.10	20,766 67
John C. Hill	0.20	0.20	0.90	1.45	0.22	4.00	3.00	15.00	0.40	0.90	0.02¼	0.05	5.25	1.60	0.15	0.10	21,925 00

ELECTRICAL.

Electric Lighting.—At Memphis, Tenn., the Thomson-Houston Electric Light Co. and the Brush Electric Light Co. have consolidated. Capital stock, $200,000.

The Citizens' Electric Light Co., of Independence, Mo. has been incorporated by W. A. Cunningham, W. S. McCoy, I. N. Rodgers and Chas. Gudgell. Capital stock $25,000.

At St. Louis, Mo., Mr. Sutter, the contractor for the new street lighting system, has secured an extension of time for the completion of his contract.

At Eugene, Ore., a contract for street lighting for three years has been awarded to the Eugene Electric Light Co. at $10 per month per light for 20 lights of 1,500 c. p.

BRIDGES, TUNNELS AND CANALS.

Bridges.—*Inter Colonial Ry.*—This company has asked for bids for the construction and delivery of two pairs of steel plate girders of 65 ft. and 60 ft. clear span respectively, the former to be a deck and the latter to be a through span. Also for the construction of a 15 ft. span stone arched culvert. Address D. Pottinger, Superintendent, Moncton, N. B.

Montreal, P. Q.—The Montreal Bridge bill has passed the Railway Committee, with amendments providing that the height of the bridge above the water shall be 170 ft., and that work must be begun within three years and finished within seven years. The capital stock of the company was increased to $3,000,000.

Tremont, Me.—A 60-ft. wooden bridge will be built at this place. Address Chas. H. Welsh, Tremont, Me.

Franklin & Tilton R. R.—This company will build several bridges on its line of railway this season. Edgar H. Woodman, Treasurer, Concord, N. H.

Springfield, Mass.—The Hudson Bridge Works, of Hudson, Mass., have been consolidated with the Hawkins Iron Works of this place. John Bartholomew is Chief Engineer.

Warren, R. I.—The contract for building the bridge at this place has been let to the King Bridge Co., of Cleveland, O. The bridge is to be 136 ft. long and 32¼ ft. wide. The roadway across the bridge will be 20 ft. wide, and sidewalks on each side 5 ft. wide. The approaches to the bridge will be 40 ft. wide at each end. The substructure is to be of heavy granite, and the superstructure of wrought iron, and it is to be a high-truss swing bridge. According to the contract it is to be completed by the 15th of August, 1890. A temporary bridge will be built, which will not prevent the interruption of travel.

Milford, Conn.—The following bids were received for the superstructure of the 79 ft. plate girder bridge at this place:

King Bridge Co., Cleveland, O.	$3,346
Wrought Iron Bridge Co., Canton, O.	3,150
Dean & Westbrook, New York City	2,950
Pittsburg Bridge Co., Pittsburg, Pa.	2,995
Variety Iron Works, Cleveland, O.	3,194
Massillon Bridge Co., Massillon, O.	2,800
Groton Bridge Co., Groton, N. Y.	2,995
Milliken Bros., New York City	4,755
Berlin Bridge Co., East Berlin, Conn.	2,377
J. E. Buddington, New Haven, Conn	2,828
R. F. Hawkins, Springfield, Mass.	2,797
Rochester Bridge Co., Rochester, N. Y.	2,685
Youngstown Bridge Co., Youngstown, O.	3,780

The contract embraces 45,000 lbs. of steel plate girder work, 1191¼ lin. ft. of railing with 8 newel posts, 6¼ M. ft. creosoted pine, and 5¼ M. ft. Georgia heart pine. Bids for the substructure were received as follows:

R. Refield & Sons	$4,222
C. W. Blakeslee & Sons	3,630
Connor Bros. & Co.	3,190

The work embraces the removal of about 300 cu. yds. of old abutments, piers, and excavation, 316 cu. yds. of new masonry, and filling and riprapping.

New York, N. Y.—The bill for the bridge across the North River has passed the Assembly.

Lane Ave., in the city of Columbus. The work will include about 1,200 cu. yds. masonry, 3,000 cu. yds. of earth excavation, and 26,000 cu. yds. of earth filling. The superstructure will be of steel, 400 ft. span, 24 ft. roadway. The bids will be received for the substructure and superstructure separately. Frank J. Reinhard, County Auditor, Franklin County, Columbus, O.—Bids will also be received until April 30, for the substructure and superstructure of a bridge across the Scioto River at this place. The work will comprise about 3,000 cu. yds. masonry, 7,000 cu. yds. earth excavation, and the steel superstructure, 300 ft. span, 24 ft. roadway, and two sidewalks 6 ft. wide each. Frank J. Reinhard, Columbus, O.

Norfolk Southern R. R.—This company will receive proposals until April 10 for the construction of 3 counterbalance pivot drawbridges, one with 60 ft. and 30 ft. arms and the others with 50 ft. and 25 ft. arms.

Madison Co., Ill.—Contracts for three bridges that are to be built over Wood River, at different points in Foster Township, have been let. One of the structures will be of iron, and the proposition of the St. Louis Bridge & Iron Co. to build the same for $1,175 was accepted. The two others will be wooden bridges, and Mr. Thomas Tichenell, of Fosterburg, was awarded the contract for constructing them at a cost of $498 for both.

Nebraska City, Neb.—The Nebraska City Highway Bridge Co. has been chartered in Nebraska to build a wagon bridge across the Missouri River at this place. The bridge, which is located about 1,800 ft. below the present Chicago, Burlington & Quincy R. R. bridge, will consist of two through spans 420 ft each, and one deck span of 350 ft.

Irrigation Canal.—The following were the bids received at Maxwell, Cal., for excavating a number of sections in the Central Irrigation District Canal: M. J. Rouke, Maxwell, 9.24 cts per cu. yd. C. McMath, Willows, 10.95 cts. Jas. McDermott, Maxwell, 9¼, 9¾, 12 and 12½ cts. on different sections. J. P. Rathbun, Williams, 8.98 cts. C. F. Davis & Sam. Montgomery, of Woodland, 11½, 12 and 12½ cts. Brown & Smart, Maxwell, 9.74 and 10 cts. J. C. Frazier & George Summy, 9, 9¼, 10, 15, 16 and 17 cts. Wm. Elliott, Sr., of Gridley, 13 cts. Turten & Knox, of Sacramento, 8½ and 8¾ cts. Bassett & Tooley, 12, 13, 13¼, 14 and 15 cts. W. F. Baker, Maxwell, 8.75 cts. on all the sections.

CONTRACTING.

Dredging.—The North American Dredging & Improvement Co., of 45 Broadway, New York, has received a contract from the Nicaragua Canal Construction Co. to dredge 1,500,000 cu. yds. to 2,000,000 cu. yds., at the entrance to Greytown Harbor.

Cement.—The District Commissioners, Washington, D. C., have awarded the contract for 875 bbls. of Portland cement to W. C. Lewis & Co., at $2.90 per bbl.

Sewers.—The Department of Public Parks, New York City, has awarded contracts to B. C. Murray at $560 and $232.

The contract for sewers at Sterling, Ill., has been awarded to the Racine Construction Co., of Racine, Wis.: 36-in. brick, $3.05 per lin. ft.; 8-in. pipe, 31 cts.; 9-in., 34 cts.; 10-in., 35 cts.; 12-in., 41 cts.; 15-in., 57 cts.; 18-in., 75 cts.; 20-in., 89 cts.; 24-in., $1.30; catch basins, $38.50; manholes, $39.

The contract for completing the Main St. sewer, Poughkeepsie, N. Y., has been awarded to M. Sullivan, of Little Falls, N. Y.; 1,100 cu. yds. of rock excavation at $3.50; laying 400 ft. of 24-in. pipe, 800 ft. of 22-in., and 160 ft. of 12-in., $3.90, $3.90 and 90 cts. per ft.; 12 manholes at $100; 6 silt basins at $200. Total, $11,088.40.

The contract for sewers at Easton, Pa., has been awarded to James Smith and D. F. Minnehan, at $114,885. The complete list of prices was given in ENGINEERING NEWS, March 22. Mr. J. J. Cooper is City Engineer.

Pipe.—The contract for 7¼ miles of 36-in. riveted pipe for the Philadelphia company's new gas pipe line from the Bellevernon field has been awarded to Riter & Conley, of Pittsburg, Pa.

Street Work.—The Barber Asphalt Co. has contracts for 244,866 sq. yds. of asphalt pavement at Buffalo.

The Street Pavement Committee, New York City, has received a proposal from the Hastings Pavement Co. to put down a sample of the company's block asphalt pavement at $3 per sq. yd.

The following proposals for cobblestone paving on Hart St. have been received by the Commissioner of City Works, Brooklyn, N. Y.: John Hickey, $6.49 per lin. ft.; Denis Norton, $5.25; William Weiss, $4.71.

At Kansas City, Mo., the contract for excavating the embankment on 17th St. from Broadway to Penn, containing 25,000 cu. yds., was awarded to Tim Brosnahan at 17 cts. per cu. yd. The contract for grading 27th St. from Indiana Ave. to Cleveland was awarded to N. C. Eaton at 10¾ cts. per cu. yd.

The contract for graveling streets at Machester, Va., has been awarded by Robert Nelson, City Engineer, to Goodwin & Allport, at 52 cts. per cu. yd.

Contracts for sidewalks at Duluth, Minn., have been awarded to T. G. Mulliken, Colby Smith and Benjamin Low, at 30, 30¼ and 31 cts. for 8, 6 and 8-ft. walks.

At Montreal, Canada, contracts have been awarded for paving Craig and William Sts., supplying 3-in. tamarac blocks, Bastien & Valiquette, $1.23 per sq. yd., or a total of $30,750; granite blocks, Robert Forsyth, at $1.84 per sq. yd., or a total of $920; chain stone, straight and curved, Desormeault & Frere, at 65 cts. and 25 cts. respectively, or a total of $4,550. Laying—Bastien & Valiquette, wooden blocks, $1.85; flagstone crossings, $2 per sq. yd.; curbstones, 30 cts., and street railway tracks, 90 cts. per lin. ft., or a total of $58,950.

Water-Works Supplies.—The following proposals have been received by John Caulfield, Secretary of the Water Commissioners, St. Paul, Minn., for 5,000 lbs. of marlin, 1,000 lbs. block tin, 60 tons of pig lead, and 50 tons of lead pipe. Jesse A. Gregg, $23, $3.98, and $4.35 per 100 lbs. for tin, lead and pipe. Northwest Shot & Lead Co., $22.25, $3.87½ and $4.35 for tin, lead and pipe. Robinson & Cary, $5.68, $23, $3.89¾ and $4.43 for marlin, tin, lead and pipe. H. P. Rugg, $5.90, $23.65, $3.95 and $4.29. L. M. Rumsey & Co., St. Louis, $22, $3.95 and $4.15 for the latter three items. H. C. McNair, $26, $3.94 and $4.20. Rogers & Ordway, $6.23, $22.12½, $3.90 and $4.20. St. Paul Brass Works, $22.75 for tin. Wm. Winslow, $6 or $7 for tar or dry marlin. Jilson & Sowden, $5.50, $6.75 or $7.37½ for marlin.

Public Buildings.—A new court house is to be erected at Vienna, Ga. Architect, W. H. Parkins, Atlanta, Ga.

A court house is to be built at Coffeeville, Yalobusha Co., Miss., at a cost of $20,000.

A new jail is to be built at Mankato, Minn.

Plans for a city jail and police patrol station have been prepared by Mr. Traphagen, architect, Duluth, Minn.

The contract for the Rock Co. court house at Bassett, Neb., has been awarded to C. J. Houseman.

Street Material.—At Baltimore, Md., the following proposals have been received by A. E. Smyrk, City Commissioner: John Harris, gutter stones, 24 cts. per lin. ft.; John Curley, 26 cts.; McClenahan Bros., Belgian blocks, $63.40 per 1,000; gutter stones, 30 cts. per lin. ft.; curb stones, $1 per lin. ft.; Woodstock Granite Co., Belgian blocks, $69; James Grant, $67.50; Wm. F. Weller, $64.40 for Belgian blocks; 95 cts. for curb stones; James H. Atkinson, 30 cts. per lin. ft. for gutter stones; Benjamin Kepner, $60 for Belgian blocks; 40 cts. for gutter stones; $1.15 for curb stones; Guilford & Walterville Granite Co., $60 for Belgian blocks and $1 for curbstones.

The following proposals for paving blocks and curbing have been received by E. L. Squier, Highway Commis-

sioner, Holyoke, Mass.: Timothy Keefe, Chester, Mass.' $1.59 and $1.95 per yd. for large and small paving; George D. Webb, Worcester, Mass., $1.65 and $1.65 for paving; 50 cts. per ft. for curbing. W. N. Flynt & Co., Monson, Mass., $1.60 and $1.80 for paving; 48 cts. for curbing. Chas. A. Bailey, Suncook, N. H., $1.90 and $1.90 for paving; 60 cts. for curbing. Geo. Lyon & Co., Greenfield, Mass., $1.70 and $1.90 for paving; 60 cts. for curbing. Pettett Bros., Worcester, Mass., $1.58 for large paving blocks; 40 cts. for curbing. J. G. Murphy & Co., Deep River, Conn., $1.90 for large blocks; 50 cts. for curbing. J. & W. Clark, $1.65, and $1.80 for blocks.

Dam.—The following proposals for the construction of a dam across the Big Sandy River, near Louisa, Ky., were received March 19, by Major D. W. Lockwood, U. S. Engineer Office, Cincinnati, O.: C. Irvine McDonald, Pittsburg, Pa., 15,000 lin. ft. of flatted timber, $1.25 per lin ft.; 8,000 ft. B. M. of squared timber, $23 per 1,000 ft. B M.; 2,500 cu. yds. of stone, 98 cts per cu. yd; 4,000 lbs. of anchor bolts, 10 cts. per lb.; 8,000 lbs of drift bolts, 5 cts. per lb.; 2,000 lbs. of spikes, 7 cts. per lb.; total, $22,324. I. V. Hoag, Jr., Pittsburg, Pa., 49 cts. and $49 for timber; $7 for stone; 13, 5 and 5 cts. for iron; total, $26,362.

PROPOSALS OPEN.

Street Railway.—Grading roadbed. J. T. Brady, President, Houston Belt & Magnolia Park Ry. Co., Houston, Tex.

Cement Walk.—About 65,000 sq. ft. H. H. Loomis, 14 Wieting Block, Syracuse, N. Y.

Railway.—Grading, clearing and grubbing, 10 miles, from Margerum to Chickasaw. A. Mitchell, Chief Engineer, Sheffield & Birmingham Construction Co., Sheffield Ala.

Street Work.—Regulating and granite block paving; also sewers. The Commissioner of Public Works, 31 Chambers St., New York City. April 8.

Valves.—Nine 36-in. and thirteen 16-in. geared screw hub water valves; one 36-in. check valve with 4-in. by-pass; the 36-in. screw valves to work horizontally. John Whitelaw, Superintendent of Water-Works, Cleveland, O. April 14.

Canal.—Section 2 of Turlock irrigation canal; scraper work, excavation 168,000 cu. yds. R. M. Williams, Secretary, Board of Directors of Turlock Irrigation District, Turlock, Cal. April 15.

Sewers.—About 9 miles. Plans and specifications on file. E. C. Fowler, Clerk of Construction Committee, Orange, Mass. April 15.

Paving.—Street paving, with hard fire or paving brick. L. G. Brock, City Clerk, Moundsville, W. Va. April 16.

Street and Sewer.—Grading main street. About 1,500 ft of sewer. F. J. O'Flaherty, County Surveyor, Kansas City, Mo. April 19.

Bridges and Culvert.—For the construction and delivery of one pair of steel plate girders for a deck bridge of 65 ft. clear span; also, for one pair of steel plate girders for a through bridge of 60 ft. clear span; also, for the construction of a stone arched culvert of 15 ft. span, near Sackville, N. B. D. Pottinger, Chief Superintendent, Intercolonial Ry., Moncton, N. B. April 19.

Bridges.—At Columbus, O., for the erection of a bridge over the Olentangy River at Lane Ave. Bids will be received for sandstone masonry (1,200 yds.), excavation (3,000 yds.); and fill (26,000 yds.). Bids will also be received for an iron or steel, or a combined iron or steel superstructure, single span, 200 ft. extreme length, one 24-ft. clear roadway, with a factor of safety of 4. For the erection of a bridge over the Scioto River at Mound St. Bids will be received for sandstone masonry (3,000 yds.); excavation (7,000 yds.); also for an iron or steel, or a combined iron and steel superstructure, single span, 300 ft. extreme length, one 24-ft. clear roadway, and two sidewalks, 6 ft, clear each, with a factor of safety of 4. Capacity 80 lbs per sq. ft. for truss and 100 per sq. ft, for floor. Bids will also be received for the old bridge located at the present site. Frank J. Reinhard, County Auditor, Columbus, O. April 30.

Electric Lighting.—Lighting streets for two years from Oct. 1. P. N. Miller, City Clerk, Ashville, N. C. May 1.

Bridge.—Across Sun River, 90 ft. long, 16 ft. wide on top 130 yds. of approaches. J. S. Tooker, Helena, Mont. June 1.

MANUFACTURING AND TECHNICAL.

Locomotives.—The New York Locomotive Works, of Rome, N. Y., have shipped two mogul engines to the San Antonio & Aransas Pass.

H. K. Porter & Co., of Pittsburg, Pa., have delivered a light engine to the Nayatt Brick Co., of Riverside, R. I.

The Rhode Island Locomotive Works, of Providence, R. I., are building four mogul freight engines for the Savannah, Americus & Montgomery. They weigh 54 tons each.

The Schenectady Locomotive Works have delivered to the New York Central & Hudson River road 3 of the 15 fast passenger engines for heavy service which were ordered last year. Ten 60-ton consolidation freight engines, with cylinders 21 × 24 ins., have been delivered to the Chesapeake & Ohio.

In May there will be received for service in hauling the fast trains of the Pennsylvania Co., between Indianapolis and Columbus, 5 large passenger engines. They will have 68-in. driving wheels, large boiler capacity, and be built for high speed as well as power.

The Atlantic & Danville R. R. has ordered a number of new engines.

The Strong Locomotive.—A daily paper states that since undergoing slight changes at the shops of the Cincinnati, Hamilton & Dayton Co., the Strong engine now hauling the vestibule trains between Indianapolis and Cincinnati has been doing some remarkable running. Recently the engine ran 14¼ miles at an average speed of a mile in 50 seconds. The quickest mile was made in 46 seconds, and the slowest mile was covered in 59 seconds. Since run on the Cincinnati, Hamilton & Dayton, the best official record the engine has shown is 84 miles in 60 minutes, hauling 4 coaches. The engine is to be tested on the Indianapolis division of the Pennsylvania lines in hauling the fast trains between Indianapolis and Columbus, O.

Cars.—The Ohio Falls Car Co., of Jeffersonville, Ind., is building passenger cars for the Savannah, Americus & Montgomery, and the Cleveland, Lorain & Wheeling.

The Indianapolis Car Works, of Indianapolis, Ind., have been awarded a contract to build 1,500 coal cars for the Columbus & Hocking Valley road. They have 750 of the 950 that they are building for the Pittsburg & Western completed. In addition to the car-building, the company is turning out 2,000 wheels a month.

The East Tennessee, Virginia & Georgia has awarded contracts for 1,500 freight cars: Southern Car Co., Knoxville, Tenn., 500; U. S. Rolling Stock Co., 800; Florida Car Works, Green Grove Springs, Fla., 200. These cars are to be equipped with air brakes and M. C. B. couplers.

The Wabash Co is building, at its own shops, 50 cars adapted for carrying fruits and vegetables between St. Louis, Chicago, Toledo and Detroit.

The Toledo & Ohio Central is in the market for 2,000 freight cars. The trouble now is for car-works to fill orders as fast as the purchasers desire.

Ventilator Cars.—The Pennsylvania R. R. has constructed a new ventilator car for the transportation of perishable fruit. The car has small windows with slat shutters in the front, rear and sides. On the inside of the windows are iron slides to cover the windows should the draught caused by the moving train be more than is required. Inside the car movable open-work shelves are placed so that fruit can be placed on the floor of the car and on the shelves. The sliding doors are provided with ventilators of iron latticework that can be closed from the inside in the same manner as the other ventilators. The railway company will build 500 of these ventilator cars and have them all in running order by June.

Electric Train Signal.—Another electrical device has been brought out to afford communication between trains in motion and to prevent accidents. Batteries and the necessary connections are placed on each engine, a central conductor is laid parallel with the rails. Should two trains approach within a certain distance of each other, an alarm is sounded in each cab on an electric gong, and the steam whistle set blowing. The engine drivers can stop the trains, and communicate, it is said, by telephones. They can communicate when the engines are stopped or running. An automatic signal is also given should a switch be misplaced or a bridge burnt or washed away. Additional batteries are placed at the stations along the road which work the alarms should those placed on the engines become broken. Mr. J. T. Odell, General Manager of the Baltimore & Ohio R. R., is President, and Mr. James R. Branch, Secretary and Treasurer. Information may be obtained from F. B. Kemp & Co. of Roanoke, Va.

Car Coupler.—The Aultman & Taylor Mfg. Co., of Wytheville, Va., will manufacture the Collins car coupler.

The Pneumatic Co., of Chicago, Ill., has been organized by J. C. Beeks, W. D. Macer and E. K. Beeks Capital stock, $250,000. The company will operate pneumatic tubes and plant.

Air Brake.—The Eames Vacuum Brake Co, has perfected an improved compressed air brake for passenger and freight cars, and is prepared to demonstrate its merits. It is quick-acting, automatic and interchangeable with the Westinghouse.

Cable Railway Yokes.—The Rogers Foundry Co., of Belleville, Ill., has a $100,000 contract for yokes for the Fifth St. cable line at St. Louis, Mo.

Brake Beams.—The Marden Steel Brake Beam Co., of Boston, Mass., has an order from the Wisconsin Central for the equipment of 500 ore cars now being built by the U. S. Rolling Stock Co.

Machine Tools.—The Portland Co., of Portland, Me., has purchased three new machines. One is a pair of shears for cutting boiler steel; this has a 43-in. reach, and cuts 12 ins. at each stroke. It will shear a plate 1¼ ins. thick. A second is a riveting machine; the boiler can be lowered between the jaws, which are worked by hydraulic force. The rivet is inserted and the jaws close with a force equal to a weight of 75 tons. Another machine is to shape the heads of a boiler. This will be 16¼ ft. in height with a piston 8 ins. in diameter. The die which shapes the heads is 8 ft. in diameter and presses the iron into shape. It is operated by steam, the cylinder being 24x48 ins., and it is for making sulphide pulp boilers.

The Berlin Iron Bridge Co., of East Berlin, Conn., is now building an extensive ship-building plant for the Chesapeake Dry Dock & Construction Co., of Newport News, Va. The company has also closed a contract with the Brooklyn Brass & Copper Co., of Brooklyn, N. Y., for the iron truss roofs of their new casting shop and rolling mill.

The Wichita Vitrified Brick Co., of Wichita, Kan., has been incorporated by F. J. Ackerman, John A. Clark and Oliver Buckwalter, of Wichita; and Edward Harpstrite, of Decatur, Ill. Capital stock, $20,000.

The Michigan Paving Co., has been organized at Detroit, Mich., as a branch of the Sicilian Asphalt Co., of New York. Capital stock, $10,000.

Sale of Gas Plant.—The plant and property of the St. Louis Gas, Fuel & Power Co. will be sold at auction May 29, at the Court House, St. Louis, Mo., in the interest of the Fidelity Insurance, Trust & Safe Deposit Co. The plant is complete, consisting of generators, tanks, boilers, engines, etc., also nearly 26 miles of 3 to 12-in. street mains, 2,267 services, 1,337 meters, tools, etc.

The Buffalo Steam Pump Co. is building a compound high-pressure pump to work with 160 lbs. steam pressure, against 2,000 lbs. This firm is busy and reports prospects very bright for the coming season.

Vaile & Young, of Baltimore, Md., have closed some large contracts for their patent metallic skylights, among them one for about 30,000 sq. ft. for the new works of the Pennsylvania Steel Co., at Sparrow's Point, Md.

The Lidgerwood Mfg. Co.'s Chicago branch reports trade as being good. A number of orders have recently been received for engines, boilers and plant for mining purposes.

Boilers.—The Keating Implement & Machine Co., of Dallas, Tex., has been appointed the representative of the Abendroth & Root Mfg. Co., of New York, in that city. The company will handle more particularly the new Root water-tube boiler, and has issued an illustrated circular, which will be sent on application.

Pumps.—The Smith & Vaile Co., of New York, makes special duplex steam pumps for hydraulic elevator service.

The Deane Steam Pump Co. has had plans prepared for new works at Holyoke, Mass. The machine shop will be 300 ft. long and 80 ft. wide, and will have one floor, with the necessary galleries. The foundry will be 194 × 76 ft. and will occupy one floor. The pattern house will be 106 × 38 ft. and will have three floors. The office and store room will be 96 × 50 ft., with two floors. The blacksmith shop, boiler room, engine and testing room will occupy a building 177 ft. long and 34 ft. wide, having one floor. The other buildings will be of brick. The factory will not use water power, but will probably have a 75 H. P. steam engine.

Railway Material.—Joseph F. Allison, Cartersville, Ga., wants 8 tons of 16-lb. rails and 25 tons of 56-lb. rails.

Westerfield, Taylor & Fornaris, New Orleans, La., want prices on one mile of 20 to 25-lb. new or second-hand rails f. o. b. New Orleans.

Brick.—J. Lippman & Co., of Yazoo City, Miss., will build cotton warehouses, and about 4,000,000 bricks will be needed next summer.

Rock Crusher wanted; Gates' patent preferred. J. T. White, 549, 553 Broadway, New York.

Metal Market Prices.—***Rails.***—New York, $34; old rails, $24.50 to $25 for iron, $21.50 for steel. Chicago: $35 to $36; old rails, $23.50 to $24.00 for iron, $18 to $21 for steel. Pittsburg: $33.50 to $34; old rails, $25 for iron, $22 to $23 for steel.

Track Materials.—New York: steel angle bars, 1.75 to 2 cts.; spikes, 2.10 to 2.20 cts.; track bolts 2.9 to 3 cts. with square, and 3.10 to 3.15 cts. with hexagon nuts. Pittsburg: splice bars, 1.95 to 2 cts.; spikes, 2.15, or 2.25 cts. delivered at Chicago or St. Louis; track bolts, 2.90 to 3 cts. with square and 3.10 to 3.20 cts. with hexagon nuts. Chicago: splice bars, 2.10 cts. for steel and 1.95 to 2 cts. for iron; spikes, 2.25 cts.; track bolts, 2.90 to 2.95 cts. with square, and 3 to 3.05 cts. with hexagon nuts.

Pipe.—Cast iron, about $27 to $30 per ton, according to competition and amount of order. Wrought iron, discounts as follows: 47½ and 40 per cent. on black and galvanized butt-welded, 60 and 47½ on black and galvanized lap-welded. The wrought iron pipe manufacturers met at Pittsburg, Pa., on March 28, and reaffirmed prices and discounts. Casing, 50 per cent. discount.

Lead.—New York, 3.85 to 3.90 cts.; Chicago, 3.80 cts.; St. Louis, 3.70 to 3.72½ cts.

Structural Material.—Chicago: iron or steel angles, 2.45 to 2.55 cts.; tees, 3 cts.; universal plates, 2.50 cts. for iron; 2.55 cts. for steel up to 16 ins. wide, 2.70 for wider steel; steelshearred plates, 2.80 cts.; beams and channels, 3.20 to 3.40 cts. Pittsburg: angles, 2.30 cts.; tees, 2.75 cts.; channels, 3.10 cts.; sheared bridge plates, 2.80 cts.; universal mill plates, 2.45 cts.; refined bars, 2.45 cts.; steel plates, 4.25 to 4.75 cts. for firebox; 3.25 cts. for flange, 3 for shell 2.75 for tank.